SECTION 06100A

ROUGH CARPENTRY

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN HARDBOARD ASSOCIATION (AHA)

AHA A135.4	(1982; R 1988) Basic Hardboard
AHA A194.1	(1985) Cellulosic Fiberboard

AMERICAN INSTITUTE OF TIMBER CONSTRUCTION (AITC)

AITC-01	(1985; 3rd Ed) Timber Construction Manual

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI A208.1	(1989) Wood Particleboard

AMERICAN PLYWOOD ASSOCIATION (APA)

APA-01	(Mar 1991) Source List - Adhesives for APA Glued Floor System
APA Form E30	(Jun 1990) Design/Construction Guide, Residential and Commercial
APA-PRP-108	(Feb 1991; Rev May 1991) Performance Standards and Policies for Structural-Use Panels

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM C 208	(1972; R 1982) Insulating Board (Cellulosic Fiber), Structural and Decorative

ASTM D 2103 (1986) Polyethylene Film and Sheeting

ASTM E 96 (1992) Water Vapor Transmission of Materials

AMERICAN WOOD PRESERVERS' ASSOCIATION (AWPA)

AWPA C28 (1991) Standard for Preservative Treatment of Structural Glued Laminated Members and Laminations Before Gluing of Southern Pine, Pacific Coast Douglas Fir, Hemfir and Western Hemlock by Pressure Processes

AWPA M4 (1991) The Core of Preservative-Treated Wood Products

AMERICAN WOOD PRESERVERS BUREAU (AWPB)

AWPB LP 2 (1988) Softwood Lumber, Timber and Plywood Pressure Treated with Waterborne Preservatives for Above Ground Use

AWPB LP 22 (1988) Softwood Lumber, Timber and Plywood Pressure Treated With Waterborne Preservative for Ground Contact Use

CALIFORNIA REDWOOD ASSOCIATION (CRA)

CRA-01 (Dec 1990) Standard Specifications for Grades of California Redwood Lumber

DEPARTMENT OF COMMERCE (DOC)

DOC PS 1 (1983) Construction and Industrial Plywood

FEDERAL SPECIFICATIONS (FS)

FS UU-B-790 (Rev A; Int Am 1) Building Paper, Vegetable Fiber: (Kraft, Waterproofed, Water Repellent and Fire Resistant)

NATIONAL FOREST PRODUCTS ASSOCIATION (NFOPA)

NFOPA-01 (1991; Supple; Errata/Addenda Mar 1992 and Jul 1992) National Design Specification for Wood Construction

NFOPA-02 (1988) Manual for Wood Frame Construction

NATIONAL HARDWOOD LUMBER ASSOCIATION (NHLA)

NHLA-01	(Jan 1990) Rules for the Measurement & Inspection of Hardwood & Cypress Lumber

NORTHEASTERN LUMBER MANUFACTURERS ASSOCIATION (NELMA)

NELMA-01	(1991) Standard Grading Rules for Northeastern Lumber

SOUTHERN CYPRESS MANUFACTURERS ASSOCIATION (SCMA)

SCMA-01	(1986) Standard Specifications for Grades of Southern Cypress

SOUTHERN PINE INSPECTION BUREAU (SPIB)

SPIB-01	(1991; Supple 2) Standard Grading Rules for Southern Pine Lumber

TRUSS PLATE INSTITUTE (TPI)

TPI QST-88	(1988) Quality Standard for Metal Plate Connected Wood Trusses Addendum to TPI-85
TPI-85	(1985; Errata; Supple; Addendum QST-88) Design Specification for Metal Plate Connected Wood Trusses

WEST COAST LUMBER INSPECTION BUREAU (WCLIB)

WCLIB Std 17	(1991) Standard Grading Rules for West Coast Lumber

WESTERN WOOD PRODUCTS ASSOCIATION (WWPA)

WWPA-01	(1991) Western Lumber Grading Rules 91

1.2 DELIVERY AND STORAGE

Materials shall be delivered to the site in undamaged condition, stored off ground in fully covered, well ventilated areas, and protected from extreme changes in temperature and humidity.

PART 2 PRODUCTS

2.1 LUMBER AND SHEATHING

2.1.1 Grading and Marking

Materials shall bear the grademark, stamp or other identifying marks indicating grades of material and rules or standards under which produced.

2.1.2 Sizes

Sizes shall conform to requirements of the rules or standards under which produced. Unless otherwise specified, lumber shall be surfaced on four sides. Size references, unless otherwise specified, are nominal sizes, and actual sizes shall be within manufacturing tolerances allowed by the standard under which the product is produced.

2.1.3 Structural and Miscellaneous Wood Members

2.1.3.1 Structural Members

Species and grades shall be as listed in NFOPA-01. Structural lumber for engineered uses, except trussed rafters, shall have allowable design values of 1000 psi in bending; 525 psi in tension parallel to the grain; 405 in compression perpendicular to the grain; 875 psi in compression parallel to the grain; 75 psi in horizontal shear; and a modulus of elasticity of 1,400,000 psi. Joists, rafters including trussed type, decking, and headers shall have design values of 1150 psi in bending for repetitive member uses. Design of members and fastenings shall conform to AITC-01. Other stress graded or dimensioned items such as blocking, carriages, sleepers and studs shall be No. 2 grade except that studs may be Stud grade.

2.1.3.2 Trussed Rafters

As an option to standard rafters, trussed rafters may be provided. The design shall be as indicated. Connections shall be made with light-metal plate-connectors. Light-metal-plate-connected wood trusses shall be designed in conformance with TPI-85 and fabricated in conformance with TPI QST-88.

When new plate configuration is proposed, load testing of trusses is required and shall conform to Appendix D of TPI-85.

2.1.3.3 Nonstress Graded Members

Members shall include bridging, corner bracing, furring, grounds, and nailing strips. Members shall be in accordance with TABLE I for the species used. Sizes shall be as follows unless otherwise shown:

Member	Size
Bridging	1 by 3 or 1 by 4 for use between members 2 by 12 and smaller; 2 by 4 for use between members larger than 2 by 12.
Corner bracing	1 by 4.
Furring	1 by 2.
Grounds	Plaster thickness by 1-1/2.
Nailing strips	1 by 3 or 1 by 4 when used as shingle base or interior finish, otherwise 2-inch stock.

2.1.3.4 Roof Decking

Roof decking shall be commercial grade with minimum design value of 1100 psi in bending. Decking shall be 2 inches thick with single tongue and groove, V-jointed, matched and dressed. As an option, fabricated laminated lumber decking with interlocking tongue and groove joints may be provided.

2.1.4 Sheathing

Sheathing shall be fiberboards, plywood, structural-use panels or wood for wall sheathing; and plywood, structural-use panels, or wood for roof sheathing.

2.1.4.1 Fiberboard

Fiberboard shall conform to ASTM C 208, Intermediate Grade, or AHA A194.1, Type IV, Grade 2 asphalt impregnated or asphalt coated to be water-resistant but vapor permeable.

2.1.4.2 Plywood

Plywood shall conform to DOC PS 1, Grade C-D with exterior glue. Sheathing for roof and walls without corner bracing of framing shall have a span rating of 16/0 or greater

for supports 16 inches on center and a span rating of 24/0 or greater for supports 24 inches on center.

2.1.4.3 Structural-Use Panels

Panels shall meet the qualification requirements of APA-PRP-108 for rated sheathing, Exposure 1 or Structural I rated sheathing, Exposure 1. Sheathing for roofs or walls without corner bracing of framing shall have a span rating of 16/0 or greater for supports 16 inches on center and shall have a span rating of 24/0 or greater for supports 24 inches on center.

2.1.4.4 Wood

Species and grade shall be in accordance with TABLE I at the end of this section; center-matched, shiplapped, or square edge. Wall sheathing shall be 1 inch thick for supports 16 or 24 inches on center without corner bracing of framing provided sheathing is applied diagonally. Roof sheathing shall be 1-inch thick for supports 16 or 24 inches on center.

2.1.5 Subflooring

2.1.5.1 Plywood

Plywood shall conform to DOC PS 1; Grade C-D with exterior glue for uses not otherwise specified; Grade C-D with exterior glue for reception of underlayment or wood flooring; underlayment grade with exterior glue, or C-C (plugged) exterior grade for use as a combination subfloor-underlayment under resilient flooring. Minimum span rating for subflooring shall be 24/16 for supports 16 inches on center, and 48/24 for supports 24 inches on center. Minimum span rating for combination subfloor-underlayment shall be 16 OC for supports 16 inches on center and 24 OC for supports at 24 inches on center.

2.1.5.2 Structural-Use Panels

Rated structural-use panels shall be qualified for subflooring or combination subfloor-underlayment under APA-PRP-108. Subflooring shall be rated sheathing with a span rating of 24/16 or greater for supports 16 inches on center and shall have span rating of 48/24 or greater for supports 24 inches on center. Combination subfloor-underlayment shall have a span rating of 16 OC or greater for supports 16 inches on center and shall have span rating for 24 OC or greater for supports 24 inches on center.

2.1.5.3 Wood

Species and grade shall be in accordance with TABLE I at the end of this section, 1-inch thick, center-matched, shiplapped, or square edge.

2.2 UNDERLAYMENT

Underlayment shall conform to one of the following:

2.2.1 Hardboard

AHA A135.4 service class, sanded one side, 1/4 inch thick, 4 feet wide.

2.2.2 Particleboard

ANSI A208.1, Grade 1-M-1, 1/4 inch thick, 4 x 4 feet.

2.2.3 Plywood

DOC PS 1, underlayment grade with exterior glue, or C-C (Plugged) exterior grade 11/32 inch thick, 4 feet wide.

2.3 PRESERVATIVE TREATMENT

Items requiring treatment shall be as shown. The treatment of lumber, timber, and plywood shall meet the requirements of AWPB LP 22 for ground contact use and fresh water exposure; of AWPB LP 2 for above ground use only, except that structural glued laminated timber shall be treated in accordance with AWPA C28. All products shall bear the appropriate AWPB Quality Mark. The wood shall then be dried to the moisture content specified and marked with the word "Dry." Surfaces of lumber that will be exposed shall not be incised. Exposed areas of treated wood that are cut or drilled after treatment shall receive a field treatment in accordance with AWPA M4. Items of all-heart material of cedar, cypress, or redwood will not require preservative treatment, except when in direct contact with soil.

2.4 ACCESSORIES AND NAILS

Accessories and nails shall be the type, size, and finish best suited for intended use unless indicated otherwise.

2.5 VAPOR RETARDER

Vapor retarder shall be polyethelene sheeting conforming to ASTM D 2103 or other equivalent material. Vapor retarder shall have a maximum vapor permeance rating of 0.5 perms as determined in accordance with ASTM E 96.

2.6 AIR INFILTRATION BARRIER

Air infiltration barrier shall be building paper conforming to FS UU-B-790, Type I, Grade D, style optional or other equipment material.

PART 3 EXECUTION

3.1 INSTALLATION OF FRAMING AND MISCELLANEOUS WOOD MEMBERS

3.1.1 General

Members shall be closely fitted, accurately set to required lines and levels, and rigidly secured in place. Nailing shall be in accordance with the recommended Nailing Schedule as contained in NFOPA-02. Where detailed nailing requirements are not specified, nail size and nail spacing shall be sufficient to develop an adequate strength for the connection without splitting the members. Installation of timber connections shall conform to applicable requirements of NFOPA-01. Members framed for passage of ducts and pipes shall be cut, notched, or bored in accordance with applicable requirements of NFOPA-02. Rafters, purlins, and joists shall be set with crown edge up. Framing shall be kept at least 2 inches away from chimneys and 4 inches away from fireplace backwalls. Leveling of joists, beams, and girders on masonry or concrete shall be with slate or steel; on wood or metal leveling shall be without shims.

3.1.2 Structural Members

Members shall be adequately braced before erection. Members shall be aligned and all connections completed before removal of bracing. Individually wrapped members shall be unwrapped only after adequate protection by a roof or other cover has been provided. Scratches and abrasions of factory-applied sealer shall be treated with two brush coats of the same sealer used at the factory.

3.1.3 Sill Plates

Sill plates shall be set level and square and anchor bolted at not more than 6 feet on centers and not more than 12 inches from end of each piece. A minimum of two anchors shall be used for each piece.

3.1.4 Partition and Wall Framing

Unless otherwise shown, studs shall be spaced 16 inches on centers. Studs shall be doubled at openings. Unless otherwise indicated, headers for openings shall be made of two pieces of stud material set on edge or solid lumber of equivalent size, and corners shall be constructed of not less than three full members. End studs of partitions abutting concrete or masonry shall be anchored thereto with expansion bolts, one near each end of each stud and at intermediate intervals of not more than 4 feet. Plates of partitions resting on concrete floors shall be anchored in place with expansion bolts, one near each end of each piece and at intermediate intervals of not more than 6 feet between bolts. In lieu of expansion bolts, anchoring into concrete may be accomplished with powder-driven threaded studs of suitable type and size and spaced at 3 feet on center. Walls and load bearing partitions shall be provided with double top plates with members lapped at least 2 feet and well spiked together.

Blocking for firestopping shall be provided so that maximum dimension of any concealed space is not over 8 feet. Corner bracing shall be installed when required by type of sheathing used or when siding, other than panel siding, is applied directly to studs. Corner bracing shall be let into the exterior surfaces of the studs at an angle of approximately 45 degrees, shall extend completely over wall plates, and shall be secured at each bearing with two nails.

3.1.5 Floor (Ceiling) Framing

Except where otherwise indicated joists shall have bearings not less than 4 inches on concrete or masonry and 1-1/2 inches on wood or metal. Joists, trimmers, headers, and beams framing into carrying members at the same relative levels shall be carried on joist hangers. Joists shall be lapped and spiked together at bearings or butted end-to-end with scab ties at joint and spiked to plates. Openings in floors shall be framed with headers and trimmers. Headers carrying more than two tail joists and trimmers supporting headers carrying more than one tail joist shall be doubled, unless otherwise indicated. Joists shall be doubled under partitions parallel with floor joists. Joists built into masonry shall be provided with a beveled fire cut so that the top of the joist does not enter the wall more than 1 inch.

3.1.6 Roof Framing or Rafters

Tops of supports or rafters shall form a true plane. Valley, ridge, and hip members shall be of depth equal to cut on rafters where practicable, but in no case less than depth of rafters. Valleys, hips, and ridges shall be straight and true intersections of roof planes. Necessary crickets and watersheds shall be formed. Rafters, except hip and valley rafters, shall be spiked to wall plate and to ceiling joists with no less than three 8-penny nails. Rafters shall be toe-nailed to ridge; valley, or hip members with at least three 8-penny nails. Rafters shall be braced to prevent movement until permanent bracing,

decking or sheathing is installed. Hip and valley rafters shall be secured to wall plates by clip angles.

Openings in roof shall be framed with headers and trimmers. Unless otherwise indicated, headers carrying more than two rafters and trimmers supporting headers carrying more than one rafter shall be double. Hip rafters longer than the available lumber shall be butt jointed and scabbed. Valley rafters longer than the available lumber shall be double, with pieces lapped not less than 4 feet and well spiked together. Trussed rafters shall be installed in accordance with TPI-85.

3.1.7 Bridging

Wood bridging shall have ends accurately bevel-cut to afford firm contact and shall be nailed at each end with two nails. Metal bridging shall be installed as recommended by the manufacturer. The lower ends of bridging shall be driven up tight and secured after subflooring or roof sheathing has been laid and partition framing installed.

3.1.8 Blocking

Blocking shall be provided as necessary for application of siding, sheathing, subflooring, wallboard, and other materials or building items, and to provide fire stopping. Blocking shall be cut to fit between framing members and rigidly nailed thereto.

3.1.9 Stair Framing

Stair framing members shall be well spiked together. Rough carriages shall be cut to exact shape required to receive finish treads and risers. Risers shall be of uniform height, and treads shall be of uniform width except as otherwise shown. Trimmers, blocking, and other framing necessary for support of finish treads, risers, newels, and railing shall be provided.

3.1.10 Nailers and Nailing Strips

Nailers and nailing strips shall be provided as necessary for the attachment of finish materials. Nailers used in conjunction with roof deck installation shall be installed flush with the roof deck system. Stacked nailers shall be assembled with spikes or nails spaced not more than 18 inches on center and staggered. Beginning and ending nails shall not be more than 6 inches from nailer end. Ends of stacked nailers shall be offset approximately 12 inches in long runs and alternated at corners. Anchors shall extend through the entire thickness of the nailer. Strips shall be run in lengths as long as practicable, butt jointed, cut into wood framing members when necessary, and rigidly secured in place.

3.1.11 Wood Sleepers

Wood sleepers shall be run in lengths as long as practicable and butt jointed with end joints in adjacent rows staggered.

3.1.12 Wood Grounds

Wood grounds shall be provided as necessary for attachment of trim, finish, and other work to plaster. Grounds shall be run in lengths as long as practicable, butt jointed, and rigidly secured in place.

3.1.13 Furring Strips

Furring strips shall be provided at the locations shown. Furring strips shall be installed at 16 inches on center unless otherwise shown, run in lengths as long as practicable, butt jointed and rigidly secured in place.

3.1.14 Rough Bucks and Frames

Rough bucks shall be set straight, true, and plumb, and secured with anchors near top and bottom of each wood member and at intermediate intervals of not more than 3 feet. Anchors for concrete shall be expansion bolts, and anchors for masonry shall be 3/16-inch by 1-1/4 inch steel straps extending not less than 8 inches into the masonry and turned down 2 inches into the masonry.

3.2 INSTALLATION OF SHEATHING

3.2.1 Fiberboard

Sheathing shall be applied with edges 1/8 inch apart at joints, fitted snugly at abutting frames of openings, and nailed or stapled in accordance with the manufacturer's approved instructions. Sheets shall be applied vertically, extended over top and bottom plates, and with all vertical and horizontal joints over supports.

3.2.2 Gypsum Board

Sheathing shall be applied with edges in light contact at joints and nailed in accordance with the manufacturer's approved instructions. Sheets 2 feet wide shall be applied horizontally with tongued edge up, with vertical joints over supports, and with vertical joints staggered. Sheets 4 feet wide shall be applied vertically, extended over top and bottom plates, and with all vertical and horizontal joints over supports.

3.2.3 Plywood and Structural-Use Panels

Sheathing shall be applied with edges 1/8 inch apart at side and end joints, and nailed at supported edges at 6 inches on center and at intermediate supports 12 inches on center. Nailing of edges shall be 3/8 inch from the edges. Wall sheathing shall extend over top and bottom plates, and if applied horizontally the vertical joints shall be made over supports and staggered. Wall sheathing over which wood shingles are to be applied shall be applied horizontally. Roof sheathing shall be applied with long dimension at right angles to supports, end joints made over supports, and end joints staggered.

3.2.4 Wood

Sheathing end joints shall be made over framing members and so alternated that there will be at least two boards between joints on the same support. Each board shall bear on at least three supports. Boards shall be nailed at each support using two nails for boards 6 inches and less in width and three nails for boards more than 6 inches in width. Roof sheathing shall not be installed where roof decking is installed.

3.3 INSTALLATION OF SUBFLOORING

3.3.1 Plywood and Structural-Use Panel

Subflooring shall be applied with long dimension at right angles to the supports, with edges 1/8 inch apart at side and end joints, and nailed at supported edges 6 inches on center and at intermediate supports 12 inches on center. Subflooring may be installed with adhesive conforming to APA-01 and nails spaced at 12 inches on center. Installation of subflooring with adhesives shall be in accordance with APA Form E30. Each panel shall have end joints made over supports and end joints staggered. Where finish flooring of different thicknesses is used in adjoining areas, wood strips of the thickness required to bring the finish flooring surfaces into the same plane shall be used under the plywood subfloor.

3.3.2 Wood

Subflooring shall be applied diagonally with end joints made over supports. Each board shall bear on at least three supports and shall be nailed at each support using two nails for boards 6 inches and less in width and three nails for boards more than 6 inches in width.

3.4 INSTALLATION OF UNDERLAYMENT

3.4.1 Hardboard

Underlayment shall be applied with edges 1/32 inch apart at joints and nailed at edges 6 inches on center and at 6 inches on center throughout remainder of panel. Nailing at edges shall be 3/8 inch from edges. A clearance of 1/4 inch shall be provided at walls. Joints of underlayment shall not be located directly over parallel joints of subflooring. Power-driven wire staples of lengths recommended by the underlayment manufacturer may be used in lieu of nails. Any surface roughness at nail heads or joints shall be lightly sanded to blend with the undisturbed surface.

3.4.2 Particleboard

Underlayment shall be applied with edges 1/32 inch apart at joints and nailed at edges 6 inches on center and at 10 inches on center throughout remainder of panel. Nailing at edges shall be 3/8 inch from edges. A clearance of 1/4 inch shall be provided at walls. Joints of underlayment shall not be located directly over parallel joints of subflooring. Power-driven wire staples of lengths recommended by the underlayment manufacturer may be used in lieu of nails. Any surface roughness at nail heads or joints shall be lightly sanded to blend with the undisturbed surface.

3.4.3 Plywood

Underlayment shall be applied with edges 1/32 inch apart at joints and nailed at edges 6 inches on center and at 8 inches on center throughout remainder of panel. Nailing at edges shall be 3/8 inch from edges. A clearance of 1/4 inch shall be provided at walls. Joints of underlayment shall not be located directly over parallel joints of subflooring. Power-driven wire staples of lengths recommended by the underlayment manufacturer may be used in lieu of nails. When plywood combination subfloor-underlayment is used in lieu of separate layers; it shall be installed as specified for plywood subfloor, except all joints shall be made over supports with edge and joints spaced 1/8 inch apart. When plywood combination subfloor-underlayment is tongued and grooved, only end joints shall require support. Tongued and grooved combination subfloor-underlayment shall be applied with joints spaced 1/8 inch apart. Any surface roughness at nail heads or joints shall be lightly sanded to blend with the undisturbed surface.

3.5 INSTALLATION OF AIR INFILTRATION BARRIER

Air infiltration barrier shall be installed in accordance with the manufacturer's recommendations.

3.6 INSTALLATION OF VAPOR RETARDER

Vapor retarder shall be applied to provide a continuous barrier at window and door frames, and at all penetrations such as electrical outlets and switches, plumbing connections, and utility service penetrations. Joints in the vapor retarder shall be lapped and sealed according to the manufacturer's recommendations.

TABLE I. SPECIES AND GRADE

Subflooring, Roof Sheathing, Wall Sheathing, Furring

Grading Rules	Species	Standard	Const Comm	No. 2 Board	No. 2	No. 3 Comm
NHLA-01	Cypress				X	
NELMA-01	Northern White Cedar					X
	Eastern White Pine	X				
	Northern Pine	X				
	Balsam Fir					X
	Eastern Hemlock-Tamarack					X
CRA-01	Redwood		X			
SCMA-01	Cypress				X	
SPIB-01	Southern Pine				X	
WCLIB Std 17	Douglas Fir-Larch	X				
	Hem-Fir				X	
	Sitka Spruce	X				
	Mountain Hemlock	X				
	Western Cedar	X				
WWPA-01	Douglas Fir-Larch	X				
	Hem-Fir				X	
	Idaho White Pine	X				
	Lodgepole Pine		X			
	Ponderosa Pine		X			
	Sugar Pine		X			

Grading ules	Species	Standard	Const Comm	No. 2 Board	No. 2	No. 3 Comm
	Englemann Spruce		X			
	Douglas Fir South		X			
	Mountain Hemlock		X			
	Subalpine Fir		X			
	Western Cedar					

END OF SECTION

SECTION 06200A

FINISH CARPENTRY

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN HARDBOARD ASSOCIATION (AHA)

AHA A135.6 (1989) Hardboard Siding

AMERICAN PLYWOOD ASSOCIATION (APA)

APA PRP-108 (Feb 1991; Rev May 1991) Performance Standards and Policies for Structural-Use Panels

AMERICAN WOOD-PRESERVERS' ASSOCIATION (AWPA)

AWPA C20 (1991) Structural Lumber - Fire-Retardant Treatment by Pressure Processes

AWPA C27 (1991) Plywood - Fire-Retardant Treatment by Pressure Processes

ARCHITECTURAL WOODWORK INSTITUTE (AWI)

AWI-02 (1988) Architectural Woodwork Quality Standards, Guide Specifications and Quality Certification Program

CALIFORNIA REDWOOD ASSOCIATION (CRA)

CRA-01 (Dec 1990) Standard Specifications for Grades of California Redwood Lumber

DEPARTMENT OF COMMERCE (DOC)

DOC PS 1 (1983) Construction and Industrial Plywood

NORTHEASTERN LUMBER MANUFACTURERS ASSOCIATION (NELMA)

NELMA-01 (1991) Standard Grading Rules for Northeastern Lumber

SOUTHERN CYPRESS MANUFACTURER'S ASSOCIATION (SCMA)

SCMA-01 (1986) Standard Specifications for Grades of Southern Cypress

SOUTHERN PINE INSPECTION BUREAU (SPIB)

SPIB-01 (1991; Supple 2) Grading Rules for Southern Pine Lumber

WEST COAST LUMBER INSPECTION BUREAU (WCLIB)

WCLIB Std 17 (1991) Grading Rules for West Coast Lumber

WESTERN WOOD PRODUCTS ASSOCIATION (WWPA)

WWPA-01 (1991) Western Lumber Grading Rules 91

WOOD MOULDING AND MILLWORK PRODUCERS ASSOCIATION (WMMPA) WMMPA

WM 6 (1987) Industry Standard for Non-Pressure Treating of Wood Millwork

1.2 SUBMITTALS

The following shall be submitted in accordance with Section 01300 SUBMITTAL DESCRIPTIONS:

1.2.1 Siding; Wood Shingles; Moldings; Fascias and Trim

Samples shall be of sufficient size to show patterns, color ranges, and types, as applicable, of the material proposed to be used.

1.3 DELIVERY AND STORAGE

Materials shall be delivered to the site in undamaged condition, stored off ground in fully covered, well-ventilated areas, and protected from extreme changes in temperature and humidity.

PART 2 PRODUCTS

2.1 WOOD ITEMS, SIDING, AND TRIM

2.1.1 Grading and Marking

Materials shall bear the grademark of a recognized association or inspection agency certified by the Board of Review, American Lumber Standards Committee, to grade the species used.

2.1.2 Sizes and Patterns

Lumber sizes and patterns shall conform to rules or standards under which produced. Unless otherwise specified, lumber shall be surfaced on four sides. Sizes and patterns for materials other than lumber shall conform to requirements of the rules or standards under which produced. Size references, unless otherwise specified, are nominal sizes, and actual sizes shall be within manufacturing tolerances allowed by the standard under which the product is produced.

2.1.3 Moisture Content

Moisture content of material shall be in accordance with the standard under which the product is produced.

2.1.4 Siding

Horizontal siding shall be hardboard, plywood, or wood. Panel siding shall be hardboard or plywood. Hardboard siding shall be made from basic hardboard specified in AHA A135.6. Plywood siding shall conform to DOC PS 1. Rated horizontal siding shall be qualified under APA PRP-108, exterior type. Wood siding shall be of the species and grades listed in TABLE I at the end of this section. Sizes shall be as indicated. All siding used on a structure shall be of the same species and grade.

2.1.5 Epoxy-Aggregate Panels

Prefinished epoxy-aggregate panels shall consist of an asbestos-free cement board base sheet with a factory applied surface of epoxy resins and decorative natural stone chips. Accessories shall be manufacturer's standard extruded matching color aluminum moldings.

2.1.6 Soffits

Soffits shall be siding grade hardboard, 3/8- or 7/16-inch thick; plywood, DOC PS 1, exterior type.

2.1.7 Fascias and Trim

Fascias and trim including exterior door and window casing, shall be species and grade listed in TABLE I at the end of this section. Sizes shall be as indicated. Metal corners may be furnished in lieu of wood cornerboards for horizontal siding; and if furnished, shall be galvanized steel and primed or aluminum and primed.

2.1.8 Moldings

Moldings shall be of the pattern indicated and shall be of a grade compatible with the finish specified.

2.1.9 Repair of Existing Woodwork

Materials used to repair existing woodwork shall match existing materials in size, grade and species to the extent possible.

2.2 NAILS AND SCREWS

Nails and screws shall be the size and type best suited for the purpose.

2.3 WOOD TREATMENT

2.3.1 Preservative Treatment

Exterior wood molding and millwork, except for all-heart material of cedar, cypress or redwood, shall be preservative-treated, in accordance with WMMPA WM 6. Treated wood which is cut shall be brush-coated with preservative used in the original treatment. Treated material shall be labeled or certified to indicated compliance.

PART 3 EXECUTION

3.1 GENERAL

3.1.1 Installation of Siding

Siding shall be accurately fitted and positioned without springing or otherwise forcing siding in place and securely fastened. Siding to have a paint finish shall have nails driven flush. Installation shall be as recommended by the manufacturer of the siding.

3.1.2 Epoxy-Aggregate Coated Panels

Panels shall be installed where shown. Installation shall be as recommended by the manufacturer of the panels.

3.2 SOFFITS

Panels shall be applied with edges at joints spaced in accordance with manufacturer's instructions, with all edges backed with framing members and securely fastened.

3.3 FASCIAS AND EXTERIOR TRIM

Exposed surfaces and square edges shall be machine sanded, caulked, and constructed to exclude water.

3.4 MOLDING AND INTERIOR TRIM

Molding and interior trim shall be installed straight, plumb, level and with closely fitted joints. Blind nailing shall be used to the extent practicable, and face nailing shall be set and stopped with a nonstaining putty to match the finish applied. Screws shall be used for attachment to metal; setting and stopping of screws shall be of the same quality as required where nails are used.

TABLE I. SPECIES AND GRADE TABLES

Grading Rules	Species	Choice	Clear	C Select	C & Better
NELMA-01	Eastern Cedar			X	
	Eastern Hemlock			X	
	Tamarack				
	Eastern W. Pine			X	
	Northern Pine			X	
	Eastern Spruce		X		
	Balsam Fir		X		
CRA-01	Redwood	X			
SCMA-01	Cypress		X		
SPIB-01	Southern Pine				X
WCLIB Std 17	Douglas Fir			X	
	Larch				
	Hemlock Fir			X	
	Mountain Hemlock			X	
	Sitka Spruce			X	

Grading Rules	Species	Choice	Clear	C Select	C & Better
WWPA-01	Douglas Fir		X		
	Larch				
	Hemlock Fir		X		
	Mountain Hemlock			X	
	Western Larch		X		
	Idaho White Pine	X			
	Lodgepole Pine		X		
	Ponderosa Pine		X		
	Sugar Pine		X		
	Englemann Spruce		X		
	Douglas Fir South		X		
	Subalpine Fir		X		

NOTE 1: Western Cedar under WCLIB Std 17 shall be Grade B; and under WWPA-01, Western Cedar shall be Grade B bevel for siding and Grade A for trim.

NOTE 2: Except as specified in NOTE 3 below, siding and exterior trim shall be any of the species listed above. Interior trim shall be any one of the species listed above and the highest grade of the species for stain or natural finish and one grade below highest grade of species for paint finish.

NOTE 3: Southern Yellow Pine, Douglas Fir, Larch, Western Larch, and Tamarack shall not be used where painting is required and may be used on exterior work only when approved and stained with a preservative type stain.

END OF SECTION

SECTION 07212

MINERAL FIBER BLANKET THERMAL INSULATION

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM C 665	1991 Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing
ASTM C 930	1992 Potential Health and Safety Concerns Associated with Thermal Insulation Materials and Accessories
ASTM D 828	1987 Tensile Breaking Strength of Paper and Paperboard
ASTM D 3833	1988 Water Vapor Transmission of Pressure-Sensitive Tapes
ASTM D 4397	1991 Polyethylene Sheeting for Construction, Industrial, and Agricultural Applications
ASTM E 84	1991 (Rev. A) Surface Burning Characteristics of Building Materials
ASTM E 96	1992 Water Vapor Transmission of Materials
ASTM E 136	1992 (Rev. A) Behavior of Materials in a Vertical Tube Furnace at 750 Degrees C

CODE OF FEDERAL REGULATIONS (CFR)

29 CFR 1910.134	Respiratory Protection

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 31	1992 Installation of Oil Burning Equipment
NFPA 54	1992 National Fuel Gas Code
NFPA 70	1993 National Electrical Code
NFPA 211	1992 Chimneys, Fireplaces, Vents, and Solid Fuel Burning Appliances

TECHNICAL ASSOCIATION OF THE PULP AND PAPER INDUSTRY (TAPPI)

TAPPI T803 OM	1988 Puncture Test for Containerboard

1.3 SUBMITTALS

Submit the following in accordance with Section 01300, SUBMITTAL DESCRIPTIONS.

1.3.1 SD-02, Manufacturer's Catalog Data

a. Blanket insulation

1.3.2 SD-06, Instructions

a. Application of blanket insulation.

1.4 DELIVERY, STORAGE, AND HANDLING

1.4.1 Delivery

Deliver materials to site in original sealed wrapping bearing manufacturer's name and brand designation, specification number, type, grade, R-value, and class. Store and handle to protect from damage. Do not allow insulation materials to become wet, soiled, crushed, or covered with ice or snow. Comply with manufacturer's recommendations for handling, storing, and protecting of materials before and during installation.

1.4.2 Storage

Inspect materials delivered to the site for damage; unload and store out of weather in manufacturer's original packaging. Store only in dry locations, not subject to open flames or sparks, and easily accessible for inspection and handling.

1.5 SAFETY PRECAUTIONS

1.5.1 Respirators

Provide installers with dust/mist respirators, training in their use, and protective clothing, all approved by National Institute for Occupational Safety and Health (NIOSH)/Mine Safety and Health Administration (MSHA) in accordance with 29 CFR 1910.134.

1.5.2 Smoking

Do not smoke during installation of blanket thermal insulation.

1.5.3 Other Safety Concerns

Consider other safety concerns and measures as outlined in ASTM C 930.

PART 2 PRODUCTS

2.1 BLANKET INSULATION

ASTM C 665, Type I, blankets without membrane coverings and II, blankets with non-reflecting coverings and III, blankets with reflective coverings; Class B, membrane-faced surface with a flame propagation resistance; critical radiant flux of 0.11 Btu/ft2 or greater, except a flame spread rating of 25 or less and a smoke developed rating of 50 or less when tested in accordance with ASTM E 84.

2.1.1 Thermal Resistance Value (R-VALUE)

As indicated for ceiling, wall and floor on drawings.

2.1.2 Recycled Materials

Provide Thermal Insulation containing recycled materials to the extent practicable, provided the material meets all other requirements of this section.

2.1.3 Prohibited Materials

Do not provide materials containing more than one percent of asbestos.

2.2 VAPOR RETARDER

a. Membrane with the following properties:

Water Vapor Permeance:	ASTM E 96: 1
Maximum Flame Spread:	ASTM E 84: 25
Combustion Characteristics:	Passing ASTM E 136

2.5 PRESSURE SENSITIVE TAPE

As recommended by the vapor retarder manufacturer and having a water vapor permeance rating of one perm or less when tested in accordance with ASTM D 3833.

2.6 ACCESSORIES

2.6.1 Adhesive

As recommended by the insulation manufacturer.

2.6.2 Mechanical Fasteners

Corrosion resistant fasteners as recommended by the insulation manufacturer.

2.6.3 Wire Mesh

Corrosion resistant and as recommended by the insulation manufacturer.

PART 3 EXECUTION

3.1 EXISTING CONDITIONS

Before installing insulation, ensure that areas that will be in contact with the insulation are dry and free of projections which could cause voids, compressed insulation, or punctured vapor retarders. If moisture or other conditions are found that do not allow the workmanlike installation of the insulation, do not proceed but notify Contracting Officer of such conditions.

3.2 PREPARATION

3.2.1 Blocking at Attic Vents and Access Doors

Prior to installation of insulation, install permanent blocking to prevent insulation from slipping over, clogging, or restricting air flow through soffit vents at eaves.

3.2.2 Blocking Around Heat Producing Devices

Install non-combustible blocking around heat producing devices to provide the following clearances:

a. Recessed lighting fixtures, including wiring compartments, ballasts, and other heat producing devices, unless these are certified by the manufacturer for installation surrounded by insulation: 3 inches from outside face of fixtures and devices or as required by NFPA 70 and, if insulation is to be placed above fixture or device, 24 inches above fixture.

b. Masonry chimneys or masonry enclosing a flue: 2 inches from outside face of masonry. Masonry chimneys for medium and high heat operating appliances: Minimum clearances required by NFPA 211.

c. Vents and vent connectors used for venting the products of combustion, flues, and chimneys other than masonry chimneys: Minimum clearances as required by NFPA 211.

f. Gas Fired Appliances: Clearances as required in NFPA 54.

g. Oil Fired Appliances: Clearances as required in NFPA 31.

Blocking around flues and chimneys is not required when insulation blanket, including any attached vapor retarder, passed ASTM E 136, in addition to meeting all other requirements stipulated in Part 2. Blocking is also not required if the chimneys are certified by the manufacturer for use in contact with insulating materials.

3.3 INSTALLATION

3.3.1 Blanket Insulation

Install and handle insulation in accordance with manufacturer's Instructions. Keep material dry and free of extraneous materials. Ensure personal protective clothing and respiratory equipment is used as required. Observe safe work practices.

3.3.1.1 Electrical wiring

Do not install insulation in a manner that would sandwich electrical wiring between two layers of insulation.

3.3.1.2 Continuity of Insulation

Install blanket insulation to butt tightly against adjoining blankets and to studs, rafters, joists, sill plates, headers and any obstructions. Where insulation required is thicker than depth of joist, provide full width blankets to cover across top of joists. Provide continuity and integrity of insulation at corners, wall to ceiling joints, roof, and floor. Avoid creating thermal bridges.

3.3.1.3 Installation at Bridging and Cross Bracing

Insulate at bridging and cross bracing by splitting blanket vertically at center and packing one half into each opening. Butt insulation at bridging and cross bracing; fill in bridged area with loose or scrap insulation.

3.3.1.4 Cold Climate Requirement

Place insulation to the outside of pipes.

3.3.1.5 Insulation Blanket with Affixed Vapor Retarder

Locate vapor retarder as indicated. Do not install blankets with affixed vapor retarders unless so specified. Unless the insulation manufacturer's instructions specifically recommend not to staple the flanges of the vapor retarder facing, staple flanges of vapor retarder at 6-inch intervals flush with face or set in the side of truss, joist, or stud. Avoid gaps and bulges in insulation and "fishmouth" in vapor retarders. Overlap both flanges when using face method. Seal joints and edges of vapor retarder with pressure sensitive tape. Stuff pieces of insulation into small cracks between trusses, joists, studs and other framing, such as at attic access doors, door and window heads, jambs, and sills , band joists, and headers. Cover these insulated cracks with vapor retarder material and tape all joints with pressure sensitive tape to provide air and vapor tightness.

3.3.1.6 Sizing of Blankets

Provide only full width blankets when insulating between trusses, joists, or studs. Size width of blankets for a snug fit where trusses, joists or studs are irregularly spaced.

3.3.1.7 Special Requirements for Ceilings

Place insulation under electrical wiring occurring across joists. Pack insulation into narrowly spaced framing. Do not block flow of air through soffit vents.

3.3.1.8 Special Requirements for Floors

Hold insulation in place with corrosion resistant wire mesh, wire fasteners, or wire lacing.

3.3.1.9 Access Panels and Doors

Affix blanket insulation to access panels greater than one square foot and access doors in insulated floors and ceilings. Use insulation with same R-Value as that for floor or ceiling.

END OF SECTION

SECTION 07600A

SHEET METALWORK, GENERAL

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

SHEET METAL AND AIR CONDITIONING CONTRACTORS NATIONAL ASSOCIATION (SMACNA)

SMACNA-02 (1987) Architectural Sheet Metal Manual

1.2 GENERAL REQUIREMENTS

Sheet metalwork shall form weathertight construction. Work shall be installed without buckles or distortion and shall allow for expansion and contraction. Exposed edges shall be hemmed. Bottom edges of exposed vertical surfaces shall be angled to form drips. Flashing at the end of a run shall be formed to direct water to the outside of the system. Joints shall be installed as specified in TABLE 3. All items essential to complete the sheet metal installation shall be provided. Roof flanges of sheet metal shall be set in bituminous cement over built-up roofing or shall be woven into shingle roofing before nailing. Sheet metalwork pertaining to heating, ventilating, and air conditioning is specified in other sections.

1.3 DELIVERY, STORAGE, AND HANDLING

Materials shall be adequately packaged and protected during shipment and shall be inspected for damage, dampness, and wet-storage stains upon delivery to the jobsite. Materials shall be clearly labeled as to type and manufacturer. Sheet metal items shall be carefully handled to avoid damage. Materials shall be stored in dry, weathertight, ventilated areas until immediately before installation.

PART 2 PRODUCTS

2.1 MATERIALS

Materials shall be standard commercial materials with weights as specified in TABLE 1. Where TABLE 1 lists more than one metal for a particular item, any listed metal may be

used unless otherwise specified. Exposed items shall be the same metal. Dissimilar metals shall not contact each other except as shown in TABLE 2.

2.2 THROUGH-WALL FLASHING

Flashing shall be copper, copper-clad stainless steel, lead or stainless steel having factory-formed deformations providing mechanical bond in mortar joints. Minimum metal thickness shall be shown in TABLE 1 except lead shall be a minimum weight of 1 pound per square foot.

PART 3 EXECUTION

3.1 PROTECTION OF ALUMINUM

Aluminum shall not be used where it will contact water which flows over copper surfaces. Aluminum that will be in contact with wet or pressure-treated wood, mortar, concrete, masonry, or ferrous metals shall be protected against galvanic or corrosive action by one of the following methods:

3.1.1 Paint

Aluminum surfaces to be protected shall be solvent cleaned and given a coat of zinc-molybdate primer and one coat of aluminum paint.

3.1.2 Nonabsorptive Tape or Gasket

Nonabsorptive tape or gasket shall be placed between the adjoining surfaces and shall be cemented to the aluminum surface using a cement compatible with aluminum.

3.2 SOLDERING, RIVETING, SEAMING, AND SEALING

3.2.1 Soldering

Soldering shall apply to copper, copper clad stainless steel, and stainless steel items. Edges of sheet metals, except lead coated material shall be pretinned before soldering is begun. Soldering shall be done slowly with well heated soldering irons so as to thoroughly heat the seams and completely sweat the solder through the full width. Edges of lead coated material to be soldered shall be scraped or wire-brushed to produce a bright surface with a liberal amount of flux brushed in before soldering is begun. Edges of stainless steel to be pretinned shall be treated with soldering acid flux. Soldering shall follow immediately after application of the flux. Upon completion of soldering, the acid flux residue shall be thoroughly cleaned from the sheet metal with a solution of washing soda in water and rinsed with clean water.

3.2.2 Riveting and Sealing

Joints in aluminum sheets 0.040 inch or less in thickness shall be made mechanically and sealed with the sealant specified.

3.2.3 Seams

Flat-lock and soldered-lap seams shall finish not less than 1-inch wide. Unsoldered plain-lap seams shall lap not less than 3 inches unless otherwise specified. Flat seams shall be made in the direction of the flow.

3.3 EXPANSION JOINTS

Expansion joints shall be provided at 40-foot intervals for copper and stainless steel and at 32-foot intervals for aluminum, except that where the distance between the last expansion joint and the end of the continuous run is more than half the required interval spacing an additional joint shall be provided. Joints shall be evenly spaced. Extruded aluminum gravel stops and fasciae shall have expansion joints at not more than 12-foot spacing.

3.4 INSTALLATION OF SPECIFIC ITEMS

Unless otherwise specified or indicated, specific items shall be fabricated and installed in accordance with the details shown in SMACNA-02.

TABLE 1. SHEET METAL WEIGHTS AND THICKNESSES

Item Description	Copper, ounce per square foot	Aluminum, inch	Stainless steel, inch	Copper clad stainless steel, inch
Building expansion joints:				
Cap	16	0.032	0.015	0.015
Waterstop - bellows or flanged-U-type	16	---	0.015	0.015
Cleats (Continuous)	24	0.050	0.025	---
Covering on minor flat, pitched or curved surfaces	20	0.040	0.018	0.018

Item Description	Copper, ounce per square foot	Aluminum, inch	Stainless steel, inch	Copper clad stainless steel, inch
Downspouts, heads and leaders	16	0.032	0.015	0.015
Flashings:				
Base	20	0.040	0.018	0.018
Cap, stepped or valley	16	0.032	0.015	0.015
Gravel stops and fasciae:				
Extrusions	--	0.075	---	---
Sheets, corrugated	16	0.032	0.015	0.015
Sheets, smooth	--	0.050	0.018	0.018
Gutters (girth):				
Up to 15 inches	16	0.025	0.018	0.018
15 to 20 inches	16	0.032	0.018	0.018
20 to 25 inches	20	0.051	0.025	0.025
25 to 30 inches	24	0.064	0.031	0.031
Gutter brackets (girth):				
Up to 15 inches	1/8"x1"	3/16"x1"	1/8"x1"	1/8"x1"
15 to 20 inches	1/4"x1"	1/4" x1"	1/8"x1-1/2"	1/8"x1-1/2"
20 to 24 inches	1/4"x1-1/2"	1/4" x2"	1/8"x2"	1/8"x2"
Gutter cleats and cover plates	16	0.032	0.015	0.015
Scupper lining	20	0.032	0.015	0.015
Strainers (wire gauge)	No. 9	No. 10	No. 12	---

Item Description	Copper, ounce per square foot	Aluminum, inch	Stainless steel, inch	Copper clad stainless steel, inch
Reglets(1)	10	---	0.010	0.010
Splash pans	16	0.040	0.018	0.018
Louvers (Width, inches):				
Up to 24 inches	--	0.040	0.025	---
24 to 36 inches	--	0.040	0.031	---
36 to 48 inches	--	0.064	0.037	---
48 to 60 inches	--	0.064	0.050	---
Copings	16	0.032	0.015	0.015
Pitch pockets	16	0.032	0.015	0.015
Through-wall, flashings above roof line	16	---	0.015	0.015
Through-wall, below roof line, except as otherwise specified in paragraph "MATERIALS"	10	---	0.010	0.010

(1) May be polyvinyl chloride.

TABLE 2. FASTENER MATERIALS

To prevent corrosion, the indicated fastener materials shall be used with the following sheet metals:

Sheet Metal	Nails	Screws	Rivets	Bolts
Aluminum	Aluminum	Aluminum	Aluminum	Aluminum
Copper	Copper	Bronze	Copper	Bronze
Copper Clad Stainless Steel	Copper or Stainless Steel	Bronze or Stainless Steel	Bronze or Stainless Steel	Bronze or Stainless Steel
Lead Coated Copper	Copper	Bronze	Bronze	Bronze
Stainless Steel	Stainless Steel	Stainless Steel	Stainless Steel	Stainless Steel

TABLE 3. SHEET METAL JOINTS

Item Designation	Type of Joint: Copper, Copper Clad Stainless Steel, Stainless Steel	Type of Joint: Aluminum	Remarks
Building expansion joint at roof	1-1/4 inch single lock standing seam, cleated.	1-1/4 inch single standing seam, cleated.	-----
Cleats (Continuous)	Butt	Butt	-----
Flashings: Base	1-inch, flat locked, soldered.	1-inch flat locked, sealed.	Use hard setting sealant for locked aluminum joints

Item Designation	Copper, Copper Clad Stainless Steel, Stainless Steel	Aluminum	Remarks
	3-inch lap for expansion joint.	3-inch lap for expansion joint.	Each expansion joint for all metals shall have one continuous strip of 1/16-inch thick by 1/4-inch wide No. 7 sealant.
Cap-in reglet	3-inch lap.	3-inch lap.	Seal groove with No. 2 or 4 sealant. (a)
Cap - two-piece	Receiver 3-inch lap. Cap piece 3-inch lap.	-----	-----
Stepped	3-inch lap.	3-inch lap.	-----
Through-wall spandrel flashing (metal)	1-1/2 inch mechanical interlock.	-----	-----
Through-wall spandrel flashing (Coated or non-metal)	-----	-----	3 inch lap with sealant
Valley	6-inch lap, cleated.	6-inch lap, cleated.	-----
Gravel stops: Extrusions	-----	Butt with 1/2-inch space.	Use sheet flashing beneath and a cover plate.

Item Designation	Copper, Copper Clad Stainless Steel, Stainless Steel	Aluminum	Remarks
Sheet, corrugated	Butt with 1/4-inch space.	Butt with 1/4-inch space.	Use sheet flashing beneath and a cover plate or a combination unit.
Sheet, smooth	Butt with 1/4-inch space.	Butt with 1/4-inch space.	Use 6-inch cover plate.
Gutters	1-1/2 inch lap, riveted and soldered.	1-inch flat locked, riveted, and sealed.	Use hard setting sealant for locked aluminum joints.
Pitch pockets	1-inch soldered lap.	1-inch flat locked and sealed.	Use hard setting sealant for locked aluminum joints.
Reglets	Butt joint.	-----	Seal reglet groove with No. 2 or 4 sealant.(a)

(a) Polyvinyl chloride type reglet shall be sealed with manufacturer's recommended butyl rubber sealant.

END OF SECTION

SECTION 07920A

CAULKING AND SEALANTS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN ARCHITECTURAL MANUFACTURERS ASSOCIATION (AAMA)

AAMA 800-86 (1986) Voluntary Specifications and Test Methods for Sealants

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM C 834 (1976; R 1986) Latex Ceiling Compounds

FEDERAL SPECIFICATIONS (FS)

FS TT-C-00598 (Rev C; Am 1) Caulking Compound, Oil and Resin Base Type (for Building Construction)

FS TT-S-00227 (Rev E; Am 3) Sealing Compound: Elastomeric Type, Multi-Component (for Caulking, Sealing, and Glazing in Buildings and Other Structures)

FS TT-S-00230 (Rev C; Am 2) Sealing Compound: Elastomeric Type, Single Component (for Caulking, Sealing, and Glazing in Buildings and Other Structures)

FS TT-S-001657 (Basic) Sealing Compound, Single Component, Butyl Rubber Based, Solvent Release Type (for Buildings and Other Types of Construction)

1.2 GENERAL REQUIREMENTS

Caulking and sealants shall be provided in joints as indicated or specified. The joint design, shape, and spacing shall be as indicated. Mixing shall be in accordance with instructions provided by the manufacturer of the sealants.

1.3 SUBMITTALS

The following shall be submitted in accordance with Section 01300 SUBMITTAL DESCRIPTIONS:

1.3.1 Materials

Manufacturer's descriptive data including backstop material, primer and sealer. Descriptive data for elastomeric sealants shall include shelf life, curing time, and mixing instructions for two component sealants.

Certificates of compliance stating that the caulking and sealants conform to the specified requirements. Certificates shall include laboratory test reports showing that the caulking and sealants have been tested within the last 12 months.

1.4 ENVIRONMENTAL REQUIREMENTS

The ambient temperature shall be within the limits of 40 to 90 degrees F when the caulking and sealants are applied.

1.5 DELIVERY AND STORAGE

Materials shall be delivered to the job in the manufacturer's original unopened containers. Caulking compound or components outdated as indicated by shelf life shall not be used. Materials shall be carefully handled and stored to prevent inclusion of foreign materials or exposure to temperatures exceeding 90 degrees F. Sealant tape shall be handled and stored in a manner that will not deform the tape.

PART 2 PRODUCTS

2.1 MATERIALS

2.1.1 No. 1 Caulking Compound

No. 1 caulking compound shall conform to FS TT-C-00598, Type I.

2.1.2 No. 2 Sealant

No. 2 sealant shall be a two-component, elastomeric-type compound conforming to FS TT-S-00227, Type II, Class A. The compound shall be supplied in pre-measured kit form for on-the-job mixing.

2.1.3 No. 3 Sealant

No. 3 sealant shall be a single-component conforming to FS TT-S-001657, Type I or II.

2.1.4 No. 4 Sealant

No. 4 sealant shall be a one-component, elastomeric-type compound conforming to FS TT-S-00230, Type II, Class A.

2.1.5 No. 6 Sealant

No. 6 sealant shall be a one-component latex sealing compound conforming to ASTM C 834.

2.1.6 No. 7 Sealant

No. 7 sealant shall be a polyisobutylene-based or isoprene-isobutylene-based pressure-sensitive tape or bead as specified or shown, conforming to Section 807.1 of AAMA 800-86.

2.1.7 No. 10 Sealant

No. 10 sealant shall be treated-type foamed-urethane strip saturated with a butylene waterproofing material or asphalt-impregnated foamed-polyurethane strip and shall be capable of sealing out moisture and weather when compressed to the extent recommended by the manufacturer for the capability of the joint. The sealant shall be furnished in the proper width to obtain the degree of compression required when installed in the joint.

2.1.8 Acoustical Sealant

Synthetic rubber or polymeric-based material shall be nonhardening type with lasting resilience and able to absorb normal movement without adhesive failure.

2.2 SEALER

Sealer for use with No. 1 caulking compound shall be aluminum paint.

2.3 PRIMER

Primer for No. 2, 3, or 4 sealant shall be as recommended by the sealant manufacturer.

2.4 BACKSTOP MATERIAL

Backstop materials shall be as recommended by the sealant manufacturer.

2.5 BOND-PREVENTIVE MATERIALS

Bond-preventive materials shall be pressure-sensitive adhesive polyethylene tape, aluminum foil or wax paper. At the option of the Contractor, backstop material with bond breaking characteristics may be installed in lieu of bond-preventive materials specified.

PART 3 EXECUTION

3.1 SURFACE PREPARATION

3.1.1 General

The surfaces of joints to be sealed shall be dry. Oil, grease, dirt, chalk, particles of mortar, dust, loose rust, loose mill scale, and other foreign substances shall be removed from all joint surfaces to be sealed. Oil and grease shall be removed with solvent and surfaces shall be wiped with clean cloths.

3.1.2 Concrete and Masonry Surfaces

Where surfaces have been treated with curing compounds, oil, or other such materials, the materials shall be removed by sandblasting or wire brushing. Laitance, efflorescence and loose mortar shall be removed from the joint cavity.

3.1.3 Steel Surfaces

Steel surfaces to be in contact with sealant shall be sandblasted or, if sandblasting would not be practical or would damage adjacent finish work, the metal shall be scraped and wire brushed to remove loose mill scale. Protective coatings on steel surfaces shall be removed by sandblasting or by a solvent that leaves no residue.

3.1.4 Aluminum Surfaces

Aluminum surfaces of windows and door frames in contact with sealants shall be cleaned of temporary protective coatings. When masking tape is used for a protective cover, the tape and any residual adhesive shall be removed just prior to applying the sealant. Solvents used to remove protective coating shall be as recommended by the manufacturer of the aluminum work and shall be nonstaining.

3.2 SEALANT USES

The sealant(s) to be used in various joints shall be indicated on the design drawing wall sections and elevations.

3.3 APPLICATION

3.3.1 Paper Masking Tape

Paper masking tape shall be placed on the finish surface on one or both sides of a joint cavity to protect adjacent finish surfaces from primer or compound smears. Masking tape shall be removed within 10 minutes after joint has been filled and tooled.

3.3.2 Bond-Preventive Materials

Bond-preventive materials for No. 2 sealant shall be installed on the bottom of the joint cavity and other surfaces indicated to prevent the sealant from adhering to the surfaces covered by the bond-preventive materials. The materials shall be carefully applied to avoid contamination of adjoining surfaces or breaking bond with surfaces other than those covered by the bond-preventive materials.

3.3.3 Backstops

The back or bottom of joints constructed deeper than indicated shall be packed tightly with backstop material to provide a joint of the depth indicated. Where necessary to provide a backstop for caulking compound, the joint shall be packed tightly with rope yarn.

3.3.4 Primer

Primer shall be used on concrete masonry units, wood, or other porous surfaces in accordance with instructions furnished with the sealant. Primer shall be applied to the joint surfaces to be sealed. Surfaces adjacent to joints shall not receive primer.

3.3.5 Caulk and Sealant

Caulk and sealant shall be applied as recommended by the manufacturer.

3.4 CLEANING

The surfaces adjoining the caulked and sealed joints shall be cleaned of smears and other soiling resulting from the caulking and sealing application as work progresses.

END OF SECTION

SECTION 08110

STEEL DOORS AND FRAMES

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM E 84	(1991a) Surface Burning Characteristics of Building Materials
ASTM E 90	(1990) Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions
ASTM E 152	(1981a) Fire Tests of Door Assemblies
ASTM E 283	(1991) Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen

DOOR AND HARDWARE INSTITUTE (DHI)

DHI-02	(1986) Installation Guide for Doors and Hardware

NATIONAL ASSOCIATION OF ARCHITECTURAL METAL MANUFACTURERS (NAAMM)

NAAMM HMMA 861	(1987) Hollow Metal Manual; Section: Guide Specifications for Commercial Hollow Metal Doors and Frames

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 80	(1990) Fire Doors and Windows
NFPA 80A	(1987) Protection of Buildings from Exterior Fire Exposures
NFPA 101	(1991) Safety to Life from Fire in Buildings and Structures

STEEL DOOR INSTITUTE (SDOI)

SDOI SDI 100 (1991) Standard Steel Doors and Frames

SDOI SDI 106 (1991) Standard Door Type Nomenclature

SDOI SDI 107 (1984) Hardware on Steel Doors (Reinforcement - Application)

1.2 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01300, SUBMITTAL DESCRIPTIONS:

SD-04 Drawings

Doors and Frames; FIO.

Drawings shall use standard door type nomenclature in accordance with SDOI SDI 106 and shall indicate the location of each door and frame, elevation of each model of door and frame, details of construction, method of assembling sections, location and extent of hardware reinforcement, hardware locations, type and location of struts and anchors for frames, and thicknesses of metal. Drawings shall include catalog cuts or descriptive data for the weatherstripping including air infiltration data.

1.3 DELIVERY AND STORAGE

To provide protection during shipment, welded unit type frames shall be strapped together in pairs with heads at opposite ends or provided with temporary steel spreaders at the bottom of each frame; and knockdown type frames shall be securely strapped in bundles. Materials shall be delivered to the site in undamaged condition, and stored out of contact with the ground and under a weathertight covering permitting good air circulation. Doors and assembled frames shall be stored in an upright position. Whenever damage becomes evident, abraded, scarred, or rusty areas shall be cleaned and touched up with the paint used for the shop painting.

PART 2 PRODUCTS

2.1 DOORS AND FRAMES

Doors and frames shall be factory fabricated conforming to SDOI SDI 100 and the additional requirements specified herein. Door grade shall be standard unless otherwise indicated on the door and door frame schedules. Exterior door will be galvanized and frame will be manufacturer's standard solid wood. Doors and frames shall be prepared

to receive hardware conforming to the templates and information provided under Section 08700A, BUILDERS' HARDWARE. Rubber silencers shall be installed into factory predrilled holes in door frames; adhesively applied silencers are not acceptable. Where frames are installed in plaster or masonry walls, plaster guards shall be provided on door frames at hinges and strikes. The Contractor shall coordinate between the hardware and door suppliers to assure that reinforcing of door assemblies for closers and other required hardware shall conform to SDOI SDI 100. Exterior doors shall have top edges closed flush and sealed against water penetration.

2.1.1 Weatherstripping

Unless otherwise specified in Section 08700A, BUILDERS' HARDWARE weatherstripping shall be as specified below. Weatherstripping for head and jamb shall be manufacturers standard elastomeric type of synthetic rubber, vinyl, or neoprene and shall be installed at the factory or on the jobsite in accordance with the door frame manufacturer's recommendations. Weatherstripping for bottom of doors shall be as shown. Air leakage rate of weatherstripping shall not exceed 0.20 cubic feet per minute per linear foot of crack when tested in accordance with ASTM E 283 at standard test conditions.

2.1.2 Transom And Sidelight Panels

Transom and sidelight panels shall be constructed as specified in SDOI SDI 100 for full flush doors and shall be nonremovable from the outside of exterior doors or the secure side of interior doors.

2.1.3 Glazing

Glazing requirements are specified in Section, 08810A, GLASS AND GLAZING. Removable glazing beads shall be screw-on or snap-on type.

2.2 THERMAL INSULATED DOORS

Interior of thermal insulated doors shall be completely filled with rigid foamed-in-place polyurethane or precured polystyrene foamed board, permanently bonded to each face panel. The U-value through the door shall not exceed 0.24. Doors with cellular plastic cores shall have a flame spread rating of not more than 75 and a smoke development factor of not more than 150 when tested in accordance with ASTM E 84.

PART 3 EXECUTION

3.1 INSTALLATION

Installation shall conform to DHI-02, The Installation of Commercial Steel Doors and Steel Frames, Insulated Steel Doors in Wood Frames, and Builders Hardware. Steel doors and frames shall be reinforced, drilled, and tapped to receive mortised hinges, locks, latches, flush bolts, and closers as required. Preparation for hardware shall be in accordance with SDOI SDI 107. Weatherstripping shall be installed at exterior door openings to provide a weathertight installation.

3.2 THERMAL INSULATED DOORS

Hardware and perimeter seals shall be adjusted for proper operation.

END OF SECTION

SECTION 08201

WOOD DOORS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

ARCHITECTURAL WOODWORK INSTITUTE (AWI)

AWI-02 (1988) Architectural Woodwork Quality Standards, Guide Specifications and Quality Certification Program

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA LD 3 (1991) High-Pressure Decorative Laminates

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 101 (1991) Safety to Life from Fire in Buildings and Structures

NATIONAL WOOD WINDOW & DOOR ASSOCIATION (NWWDA)

NWWDA I.S. 1 (1987) Wood Flush Doors

NWWDA I.S. 4 (1981) Water-Repellent Preservative Treatment for Millwork

NWWDA I.S. 6 (1991) Wood Stile and Rail Doors

WEST COAST LUMBER INSPECTION BUREAU (WCLIB)

WCLIB Std 17 (1991) Grading Rules for West Coast Lumber

1.2 GENERAL REQUIREMENTS

1.2.1 Standard Products

Doors shall be of the type, size, and design indicated on the drawings, and shall be the standard products of manufacturers regularly engaged in the manufacture of wood doors.

1.2.2 Marking

Each door shall bear a stamp, brand, or other identifying mark indicating quality and construction of the door. The identifying mark or a separate certification shall include identification of the standard on which construction of the door is based, identity of the manufacturing plant, identification of the standard under which preservative treatment, if used, was made, and identification of the doors having a Type I glue bond.

1.2.3 Drawings

Drawings indicating the location of each door, elevation of each type of door, details of construction, marks to be used to identify the doors, and location and extent of hardware blocking. Drawings shall include catalog cuts or descriptive data for weatherstripping and thresholds to be used.

1.3 STORAGE

Doors shall be stored in fully covered areas and protected from damage and from extremes in temperature and humidity. Doors shall be stored on supports to prevent warping or twisting, and to provide ventilation. Factory cartons or wrappers shall be kept intact until installation.

1.4 HARDWARE

Hardware, including weatherstripping and thresholds, is specified in Section 08700A, BUILDERS' HARDWARE.

1.5 GLAZING

Glazing is specified in Section 08810A, GLASS AND GLAZING.

PART 2 PRODUCTS

2.1 GENERAL FABRICATION REQUIREMENTS

2.1.1 Edge Sealing

All wood end-grain exposed at edges of doors shall be sealed prior to shipment.

2.1.2 Preservative Treatment

Exterior softwood doors shall be water-repellent preservative treated in accordance with NWWDA I.S. 4.

2.1.3 Adhesives

Adhesives shall be in accordance with NWWDA I.S. 1, using requirements for Type I Bond Doors for exterior doors and requirements for Type II Bond Doors for interior doors. Adhesive for doors to receive a transparent finish shall be nonstaining.

2.1.4 Prefitting

Doors shall be furnished prefitted or unfitted at the option of the Contractor, except plastic laminate clad doors shall be furnished prefit in accordance with the standards under which they are produced.

2.1.5 Core Construction

2.2.5.1 Solid Cores

Where not otherwise required by fire rating, construction shall be glued wood block core or particle board core with stiles and rails bonded to the core.

2.2.5.2 Hollow Cores

Hollow core doors shall be provided with wood stiles, rails, and lock blocks of sufficient width for the application of door mounted hardware.

2.3 Face Panels

2.3.1 Natural Finished Doors

Doors to receive natural finish shall be of Good Grade with birch veneer in accordance with NWWDA I.S. 1. Vertical stile strips shall be selected to provide edges of the same species and/or color as the face veneer.

2.3.2 Painted Doors

Doors to receive paint finish shall be Sound Grade veneer in accordance with NWWDA I.S. 1, or shall be Standard Grade in accordance with NWWDA I.S. 6. Doors shall be hardwood plywood faced only.

2.3.3 Natural Finished Doors

Doors to receive natural finish shall be Selected Grade in accordance with WCLIB Std 17.

2.3.4 Painted Doors

Doors to receive paint finish shall be Standard Grade in accordance with NWWDA I.S. 6 or WCLIB Std 17.

2.3.5 Factory Coated Natural Finish

Doors indicated to receive factory coated natural finish shall be given a transparent finish conforming to AWI-02, Test 1500, Custom Grade, medium stain, medium rubbed sheen, open grain effect. Finish shall be AWI factory finish system Number 3 or 4. Color of the natural finish shall be as indicated on the Room Finish and Color Schedule. Edges of unfitted doors shall be field finished after fitting to the frames.

2.4 WOOD FRAMES

Wood frames shall be provided where shown on the drawings. For exterior door openings, frames shall be rabbeted from a solid board to provide an integral stop. For interior frames, applied stops are permitted unless otherwise indicated. Where natural finished wood doors are indicated, the wood species and finish for frames and trim shall match the doors.

PART 3 EXECUTION

3.1 INSTALLATION OF DOORS

3.1.1 Installation of Doors

Doors shall be fit, hung, and trimmed as required. Door shall have a clearance of 1/8-inch at the sides and top and shall have a bottom clearance of 1/4-inch over thresholds and 1/2-inch at other locations unless otherwise shown. The lock edge or both edges of doors shall be beveled at the rate of 1/8-inch in 2 inches. Cuts made on the job shall be sealed immediately after cutting, using a clear varnish or sealer. Bottom of doors shall be undercut to allow clear door swing over carpeted areas.

Vertical edges of doors which have not been rounded or beveled at the factory shall be eased when the doors are installed.

3.2 INSTALLATION OF WOOD FRAMES

Frames shall be set plumb and square, and rigidly anchored in place using finish type nails. Double wedge blocking shall be provided near the top, bottom, and mid-point of each jamb.

END OF SECTION

SECTION 08520A

ALUMINUM WINDOWS

PART 1 GENERAL

1.1 REFERENCES

The publication listed below forms a part of this specification to the extent referenced. The publication is referred to in the text by basic designation only.

AMERICAN ARCHITECTURAL MANUFACTURER'S ASSOCIATION (AAMA)

AAMA 101	(1988) Voluntary Specifications for Aluminum Prime Windows and Sliding Glass Doors

1.2 SUBMITTALS

The following shall be submitted in accordance with Section 01300 SUBMITTAL DESCRIPTIONS:

1.2.1 Aluminum Windows

Manufacturer's descriptive data and catalog cuts.

Certificates stating that the windows conform to the specified requirements. Quality certification labels affixed to windows in accordance with AAMA 101 windows will be acceptable in lieu of certificates.

1.3 STORAGE

Windows shall be stored out of contact with the ground and under weathertight covering.

PART 2 PRODUCTS

2.1 WINDOWS

Windows shall conform to the following AAMA 101 designations as necessary.

WINDOW	DESIGNATION
Awning	A-C20
Basement	P-C20
Casement	C-C20
Double Hung	DH-C20
Single Hung	DC-C20
Fixed	F-C20
Horizontal-Sliding	HS-C20
Top-Hinged	TH-C20
Vertically-pivoted	VP-C20

2.2 INSECT SCREENS

Insect screens shall be provided for sash, ventilators, or window units noted or scheduled. Screens shall conform to AAMA 101.

2.3 FINISH

All exposed members shall be free of scratches and other serious surface blemishes.

PART 3 EXECUTION

3.1 INSTALLATION

Installation shall be in accordance with the manufacturer's instructions. Where aluminum surfaces are in contact with, or fastened to dissimilar materials, except stainless steel or zinc, the aluminum surface shall be protected from dissimilar materials as specified in the Appendix of AAMA 101.

3.2 ADJUSTMENTS

Adjustments shall be made to operating sash or ventilators to assure smooth operation and units shall be weathertight when locked closed.

3.3 CLEANING

Windows shall be cleaned on both exterior and interior in accordance with manufacturer's recommendations.

END OF SECTION

SECTION 08610A

WOOD WINDOWS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

NATIONAL WOOD WINDOW & DOOR ASSOCIATION (NWWDA)

NWWDA IS 2 (1987) Wood Windows

1.2 DESCRIPTION

The glass and ventilating areas of the windows furnished shall be not less than such areas of the windows indicated. The next larger standard-stock size shall be furnished where windows larger than the openings indicated are required to meet this requirement, and it shall be the Contractor's responsibility to provide proper size openings where windows varying in size from those indicated are furnished.

1.3 SUBMITTALS

The following shall be submitted in accordance with Section 01300 SUBMITTAL DESCRIPTIONS:

1.3.1 Wood Windows

Manufacturer's descriptive data, catalog cuts and cleaning recommendation.

Certificates stating that the windows conform to the specified requirements. Performance certification labels affixed to windows stating grade levels in accordance with NWWDA IS 2 will be acceptable in lieu of certificates.

1.4 STORAGE

Windows shall be stored out of contact with the ground and under weathertight covering.

1.5 FACTORY PRIMING

Windows with surfaces to receive paint finish shall be furnished factory primed.

PART 2 PRODUCTS

2.1 WOOD WINDOWS

Windows shall consist of complete units meeting the requirements of NWWDA IS 2 with insect screens. Units shall meet Grade 40 performance requirements in NWWDA IS 2. Window type shall be double hung.

2.2 GLASS AND GLAZING

Glass and glazing materials shall conform to Section 08810A, GLASS AND GLAZING.

PART 3 EXECUTION

3.1 INSTALLATION

Installation shall be in accordance with the manufacturer's instructions. Windows shall be securely anchored in place to a straight, plumb, and level condition without distortion.

3.2 ADJUSTMENTS

Final adjustment for proper operation of unit shall be made after glazing. Adjustments shall be made to assure smooth operation and units shall be weathertight when locked closed.

3.3 CLEANING

Windows shall be cleaned on both exterior and interior in accordance with manufacturer's recommendations.

END OF SECTION

SECTION 08620

POLYVINYL CHLORIDE (PVC) WINDOWS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN ARCHITECTURAL MANUFACTURERS ASSOCIATION (AAMA)

AAMA 101	(1988) Voluntary Specifications for Aluminum Prime Windows and Sliding Glass Doors
AAMA 1503.1	(1988) Voluntary Test Method for Thermal Transmittance and Condensation Resistance of Windows, Doors and Glazed Wall Sections

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM D 4099	(1989) Poly(Vinyl Chloride) (PVC) Prime Windows/Sliding Glass Doors

1.2 SUBMITTALS

SD-01 Data

Windows, Insect Screens and Cleaning

Manufacturer's descriptive data, catalog cuts, and manufacturer's cleaning recommendations.

SD-06 Instructions

Installation

Manufacturer's installation instructions.

SD-13 Certificates

Windows; Insect Screens.

Certificates shall state that the windows conform to the specified requirements. Quality certification labels affixed to windows in accordance with ASTM D 4099 will be acceptable in lieu of certificates.

1.3 DELIVERY AND STORAGE

All equipment delivered and placed in storage shall be stored with protection from the weather, humidity and temperature variation, dirt and dust, or other contaminants.

PART 2 PRODUCTS

2.1 WINDOWS

Windows shall conform to ASTM D 4099, Grade 50. Windows shall be glazed with sealed insulated glass and shall have a minimum condensation resistance factor in accordance with AAMA 1503.1. Thermal conductivity through the complete window unit shall be in accordance with AAMA 1503.1.

2.2 GLASS AND GLAZING

Glass and glazing shall conform to Section 08810A, GLASS AND GLAZING.

2.3 INSECT SCREENS

Insect screens shall be provided for sash or ventilators of window units noted or scheduled. Screens shall conform to ASTM D 4099. Insect screens shall be designed for the type of window with which they will be used and shall be interchangeable with other units of the same size and type. Aluminum frame insect screens shall have a baked enamel finish in color to match the windows.

2.4 CAULKING AND SEALANTS

Caulking and sealants shall be in accordance with Section 07920A, CAULKING AND SEALANTS.

2.5 FINISH

Exposed members shall be free of scratches and other serious surface blemishes. Prime windows shall be finished in color as selected from manufacturers standard color charts.

PART 3 EXECUTION

3.1 INSTALLATION

Installation shall be in accordance with the approved installation instructions. Windows shall be securely anchored in place to a straight, plumb, and level condition without distortion. Final adjustment for proper operation of ventilating unit shall be made after glazing. Where aluminum surfaces are in contact with, or fastened to dissimilar materials, except stainless steel or zinc, the aluminum surface shall be protected from dissimilar materials as specified in the Appendix of AAMA 101. Surfaces in contact with sealants after installation shall not be coated with any type of protective material.

3.2 ADJUSTMENTS

Adjustments shall be made to operating sash or ventilators to assure smooth operation. Units shall be weathertight when locked closed.

3.3 CLEANING

Windows shall be cleaned on both exterior and interior in accordance with manufacturer's recommendations.

END OF SECTION

SECTION 08700A

BUILDERS' HARDWARE

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI A117.1	(1986) Providing Accessibility and Usability for Physically Handicapped People

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM E 283	(1991) Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls and Doors Under Specified Pressure Differences Across the Specimen

BUILDERS HARDWARE MANUFACTURERS ASSOCIATION (BHMA)

BHMA A156.1	(1988) Butts and Hinges
BHMA A156.2	(1989) Bored and Preassembled Locks and Latches
BHMA A156.3	(1989) Exit Devices
BHMA A156.4	(1986) Door Controls - Closers
BHMA A156.5	(1984) Auxiliary Locks & Associated Products
BHMA A156.6	(1986) Architectural Door Trim
BHMA A156.7	(1988) Template Hinge Dimensions
BHMA A156.8	(1988) Door Controls - Overhead Holders
BHMA A156.13	(1987) Mortise Locks & Latches
BHMA A156.15	(1986) Closer Holder Release Devices

BHMA A156.16	(1989) Auxiliary Hardware
BHMA A156.18	(1987) Materials and Finishes
BHMA A156.21	(1989) Thresholds

DOOR AND HARDWARE INSTITUTE (DHI)

DHI-02	(1986) Installation Guide for Doors and Hardware
DHI-04	(1976) Recommended Locations for Builders' Hardware for Custom Steel Doors and Frames
DHI-05	(1990) Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames
DHI A115-W	(1988) Wood Door Hardware Standards - Complete Set (Incl A115-W1 thru A115-W9)

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 80	(1990) Fire Doors and Windows
NFPA 101	(1991) Safety to Life from Fire in Buildings and Structures
NFPA 105	(1989; Int Am 89-1) Installation of Smoke- and Draft-Control Door Assemblies

1.2 SUBMITTALS

The following shall be submitted in accordance with Section 01300 SUBMITTAL DESCRIPTIONS:

Hardware and Accessories

Manufacturer's descriptive data, technical literature, catalog cuts, and installation instructions. Spare parts data for locksets, exit devices, closers, electric locks, electric strikes, electro-magnetic closer holder release devices, and electric exit devices, after approval of the detail drawings, and not later than 1 month prior to the date of beneficial occupancy. The data shall include a complete list of parts and supplies, with current unit prices and source of supply.

1.3 DELIVERY, STORAGE, AND HANDLING

Hardware shall be delivered to the project site in the manufacturer's original packages. Each article of hardware shall be individually packaged in the manufacturer's standard commercial carton or container, and shall be properly marked or labeled to be readily identifiable with the approved hardware schedule.

1.4 SPECIAL TOOLS

Special tools, such as those supplied by the manufacturer, shall be provided as required to adjust hardware items.

PART 2 PRODUCTS

2.1 GENERAL HARDWARE REQUIREMENTS

Hardware shall conform to the requirements specified herein and the HARDWARE SETS listing at the end of this section. Hardware items providing accessibility and usability for physically handicapped shall comply with ANSI A117.1.

2.2 TEMPLATES

Templates of hinges shall conform to BHMA A156.7.

2.3 HINGES

Hinges shall conform to BHMA A156.1. Hinges used on metal doors and frames shall also conform to BHMA A156.7.

2.3.1 Hinges for Reverse Bevel Doors with Locks

Hinges for reverse bevel doors with locks shall have pins that are made nonremovable by means such as a set screw in the barrel, or safety stud, when the door is in the closed position.

2.3.2 Contractor's Option

Hinges with antifriction bearings may be furnished in lieu of ball bearing hinges, except where prohibited for fire doors by the requirements of NFPA 80.

2.4 LOCKS AND LATCHES

To the maximum extent possible, locksets, latchsets and deadlocks shall be the products of a single manufacturer. Knob diameter shall be 2-1/8 to 2-1/4 inches.

2.4.1 Mortise Lock and Latchsets

Mortise lock, latchsets, and strikes shall be series 1000 and shall conform to BHMA A156.13, operational Grade 1.

2.4.2 Bored Lock and Latchsets

Bored lock, latchsets, and strikes shall be series 4000 and shall conform to BHMA A156.2, Grade 1.

2.4.3 Auxiliary Locks and Associated Products

Bored and mortise deadlocks and latchsets, narrow style locks, and rim locks shall conform to BHMA A156.5.

2.4.4 Lock Cylinders (Mortise, Rim and Bored)

Lock cylinders shall comply with BHMA A156.5. Lock cylinder shall have not less than six pins. Cylinders shall have key removable type cores. Disassembly of knob or lockset shall not be required to remove core from lockset.

2.4.5 Push/Pull Latches

Push/pull latches shall conform to BHMA A156.2.

2.4.6 Lock Trim

Lock trim shall be cast, forged, or heavy wrought construction of commercial plain design. In addition to meeting the test requirement of BHMA A156.2 or BHMA A156.13, knobs, roses, and escutcheons shall be 0.050 inch thick, if unreinforced. If reinforced, the outer shell shall be 0.035 inch thick and the combined thickness shall be 0.070 inch except that knob shanks shall be 0.060 inch thick.

2.5 EXIT DEVICES AND EXIT DEVICE ACCESSORIES

Exit devices and exit device accessories shall conform to BHMA A156.3, Grade 1. Door coordinator with carry bar shall be Type 21 and shall be provided for each pair of doors equipped with an overlapping astragal.

2.6 KEYING

Locks shall be keyed in sets or subsets as scheduled. Locks shall be furnished with the manufacturer's standard construction key system. Keys shall be supplied as follows:

Locks: 2 change keys each lock.

The keys shall be furnished to the Contracting Officer arranged in sets or subsets as scheduled.

2.7 SMOKE DETECTORS AND MAGNETIC HOLDERS

Smoke detectors and magnetic holders shall conform to BHMA A156.15.

2.8 AUXILIARY HARDWARE

Auxiliary hardware, consisting of door stops, shall conform to BHMA A156.16.

2.9 MISCELLANEOUS

2.9.1 Metal Thresholds

Thresholds shall conform to BHMA A156.21. Thresholds for exterior doors shall be extruded aluminum of the type indicated and shall provide proper clearance and an effective seal with specified weather stripping.

2.9.2 Rain Drips

Extruded aluminum, not less than 0.07 inch thick, mill finished. Door sill rain drips shall be 1-1/2 inches to 1-3/4 inches high by 5/8 inch projection. Overhead rain drips shall be approximately 1-1/2 inches high by 2-1/2 inches projection and shall extend 2 inches on either side of the door opening width.

2.9.3 Aluminum Housed Type Weatherseals

Weatherseals of the type indicated shall consist of extruded aluminum retainers not less than 0.07 inch wall thickness with vinyl, neoprene, silicone rubber, polyurethane or vinyl brush inserts. Aluminum shall be clear (natural) anodized. Weatherseal material shall be of an industrial/commercial grade. Air leakage rate of weatherstripping shall not exceed 0.5 cubic feet per minute per lineal foot of crack when tested in accordance with ASTM E 283 at standard test conditions.

2.9.4 Gasketing

Gasketing shall be a compression type seal, silicon based, self-adhesive product for use on steel door frames with wood doors for 20-minute C-label. Color shall be white. Air leakage rate of weatherstripping shall not exceed 0.5 cubic feet per minute per lineal foot of crack when tested in accordance with ASTM E 283 at standard test conditions.

2.10 FASTENINGS

Fastenings of proper type, size, quantity, and finish shall be supplied with each article of hardware.

2.11 FINISHES

Unless otherwise specified, finishes shall conform to those identified in BHMA A156.18.

PART 3 EXECUTION

3.1 APPLICATION

Hardware shall be located in accordance with DHI-04 and DHI-05. When approved, slight variations in locations or dimensions will be permitted. Application shall be in accordance with DHI-02 or DHI A115-W.

3.1.1 Weatherseals

Weatherseals shall be located as indicated, snug to door face and fastened in place with color matched metal screws after door and frames have been finish painted. Screw spacing shall be as recommended by manufacturer.

3.1.2 Gasketing

Gasketing shall be installed at the inside edge of the hinge and head and latch sides of door frame. Frames shall be toleranced for a 1/8 inch clearance between door and frame. Frames shall be treated with tape primer prior to installation.

END OF SECTION

SECTION 08810A

GLASS AND GLAZING

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM C 1036	(1991) Flat Glass
ASTM C 1048	(1991) Heat-Treated Flat Glass - Kind HS, Kind FT Coated and Uncoated Glass
ASTM E 163	(1984) Fire Test of Window Assemblies
ASTM E 773	(1988) Seal Durability of Sealed Insulating Glass Units
ASTM E 774	(1988) Sealed Insulating Glass Units

FEDERAL SPECIFICATIONS (FS)

FS DD-M-411	(Rev C) Mirrors, Glass

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 80	(1990) Fire Doors and Windows

1.2 GENERAL

Glass shall be provided in the locations indicated. Glazing may be performed in the shop or in the field using glass of the quality and thickness specified or indicated.

1.3 SUBMITTALS

The following shall be submitted in accordance with Section 01300 SUBMITTAL DESCRIPTIONS:

Glass; Setting Materials

Manufacturer's descriptive product data, handling and storage recommendations, and installation instructions.

1.4 DELIVERY AND STORAGE

Glazing compounds shall be delivered to the site in the manufacturer's unopened containers. Glass shall be stored in a safe, well ventilated dry location and shall not be unpacked until needed for installation.

1.5 GUARANTEE

Insulating glass units shall be guaranteed not to develop material obstruction to vision as a result of dust or film formation on the inner glass surfaces caused by failure of the hermetic seal or loss of dehydration, other than through glass breakage, within a 10-year period following installation.

PART 2 PRODUCTS

2.1 GLASS

Glass shall conform to the requirements of ASTM C 1036 unless specified otherwise. Where not otherwise indicated, 1/8-inch thick glass shall be provided for glazing openings up to and including 21 square feet; 3/16-inch thick shall be provided for glazing openings over 21 square feet but not over 36 square feet; 7/32-inch thick shall be provided for glazing openings over 36 square feet but not over 45 square feet.

2.1.1 Primary Glass

Type I, Class I, Quality q3, shall be provided for glazing openings not indicated or specified otherwise.

2.1.2 Insulating Glass Units

Formed of two pieces of Type I, Class I, Quality q3 glass, separated by a 3/16-inch dehydrated air space, hermetically sealed. Insulating glass units shall have polyisobutylene primary seal with two part silicone secondary seals. Aluminum spacer frame shall have bent or soldered corners. Insulating glass units shall conform to ASTM E 773 and ASTM E 774 Class A.

2.2 SETTING MATERIALS

2.2.1 Glazing Compound and Preformed Glazing Sealants

Suitable type approved for the application.

2.2.2 Glazing Accessories

As required to supplement the accessories provided with the items to be glazed and to provide a complete installation.

PART 3 EXECUTION

3.1 INSTALLATION

Glazing shall be performed in accordance with the approved installation instructions of the glass manufacturer.

3.2 CLEANING

Glass surfaces shall be thoroughly cleaned with labels, paint spots, putty, and other defacement removed, and shall be clean at the time the work is accepted.

END OF SECTION

SECTION 09250A

GYPSUM WALLBOARD

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM C 36	(1991) Gypsum Wallboard
ASTM C 442	(1991) Gypsum Backing Board and Coreboard
ASTM C 630	(1991) Water-Resistant Gypsum Backing Board
ASTM C 645	(1988) Non-Load (Axial) Bearing Steel Studs, Runners (Track), and Rigid Furring Channels for Screw Application of Gypsum Board
ASTM C 754	(1988) Installation of Steel Framing Members to Receive Screw-Attached Gypsum
ASTM C 840	(1988) Application and Finishing of Gypsum Board
ASTM C 931	(1991) Exterior Gypsum Soffit Board
ASTM C 955	(1988) Load-Bearing (Transverse and Axial) Steel Studs, Runners (Track), and Bracing or Bridging for Screw Application of Gypsum Board and Metal Plaster Bases

FACTORY MUTUAL ENGINEERING AND RESEARCH (FM)

FM P8016	(1992) Specification Tested Products Guide

GYPSUM ASSOCIATION (GA)

GA 600	(1988) Fire Resistance and Sound Control Design Manual

UNDERWRITERS LABORATORIES (UL)

UL-05 (1992) Fire Resistance Directory

1.2 SUBMITTALS

The following shall be submitted in accordance with Section 01300 SUBMITTAL DESCRIPTIONS:

Certificates shall state that the framing and wallboard materials meet the specified requirements.

1.3 DELIVERY AND STORAGE

Wallboard delivered prior to use shall be stored off the ground within a completely enclosed structure or completely enclosed within a weathertight covering. Wallboard shall be dry, free of warpage, and have bundling tape intact immediately prior to use. Application shall commence only after the structure is completely weathertight.

PART 2 MATERIALS

2.1 MATERIALS

Materials shall conform to the requirements specified below. Miscellaneous items not otherwise specified shall be as recommended by the wallboard manufacturer and approved prior to use. The long edges of wallboard shall be tapered, except when used as a base layer in a double layer application. Power driven fasteners may be used only when approved in writing. Thickness of wallboard shall comply with the systems, as detailed on the drawings.

2.1.1 Vapor Retarder

Foil-backed gypsum board or 4-mil polyethylene.

2.1.2 Gypsum Wallboard

ASTM C 36; regular, foil-backed, or Type X (Special Fire-Resistant), as required; 48-inches wide.

2.1.3 Water-Resistant Gypsum Board

ASTM C 630; surface shall be paintable; regular, or Type X (Special Fire-Resistant), as required; 48-inches wide.

2.1.4 Accessories

Finishing materials, fasteners, and adhesives shall comply with ASTM C 840.

2.1.5 Cornerbead and Edge Trim

Corrosion protective-coated steel designed for its intended use. Flanges shall be free of dirt, grease, and other materials that may adversely affect the bond of joint treatment.

PART 3 EXECUTION

3.1 STEEL FRAMING

Installation of steel framing shall conform to ASTM C 754. Limiting heights shall be according to manufacturer's current published data, based on a transverse load of 5 psf without exceeding a deflection of L/240.

3.1.1 Wall Openings

For wall openings such as required for doors, pass-through openings, and access panels, the framing system shall provide for the installation and anchorage of the required subframes or finish frames. Partitions abutting continuous suspended ceilings shall be strengthened for rigidity at rough openings, such as door openings, of more than 30-inches wide. Studs at openings shall be 20 gauge minimum bare metal thickness and spot grouted at jamb anchor inserts. Double studs shall be fastened together and secured to floor and overhead runners with screws.

3.2 APPLICATION OF GYPSUM WALLBOARD

Gypsum wallboard, board, or panels shall be applied to framing and furring members in accordance with ASTM C 840.

3.3 VAPOR RETARDER

Vapor retarder shall be installed with joints over framing members. Joints shall be lapped for the full width of the framing members. Foil-backed wallboard may be used in lieu of a separate vapor retarder sheet, in which case the reflective surface of the foil-backed wallboard shall be placed against the face of the framing members.

3.4 FINISHING OF GYPSUM WALLBOARD

Gypsum wallboard shall be taped and finished in accordance with ASTM C 840. Joint, fastener depression, and corner treatment shall be provided.

3.5 FIRE-RESISTANT ASSEMBLIES

Wherever fire-rated gypsum wallboard construction is indicated, the fire-rated assembly shall be in accordance with the specifications contained in the UL-05, FM P8016 or GA 600 for the Design Number indicated.

3.6 PATCHING

Surface defects and damage shall be corrected as required to leave gypsum wallboard smooth, uniform in appearance, and ready to receive finish as specified.

END OF SECTION

SECTION 09310A

CERAMIC TILE

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI A108.1	(1985) Installation of Grout in Ceramic Tile, with Portland Cement Mortar
ANSI A108.4	(1985) Installation of Ceramic Tile with Organic Adhesives or Water Cleanable Tile Setting Epoxy Adhesive
ANSI A108.5	(1985) Installation of Ceramic Tile with Dry-Set Portland Cement Mortar or Latex-Portland Cement Mortar
ANSI A108.6	(1985) Installation of Ceramic Tile with Chemical Resistant, Water Cleanable Tile-Setting and -Grouting Epoxy
ANSI A108.7	(1985) Electrically Conductive Ceramic Tile Installed with Conductive Dry-Set Portland Cement Mortar
ANSI A108.10	(1985) Installation of Grout in Tilework
ANSI A137.1	(1988) Ceramic Tile

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM C 448	(1988) Abrasion Resistance of Porcelain Enamels
ASTM C 578	(1987a) Preformed, Cellular Polystyrene Thermal Insulation
ASTM D 1186	(1987) Nondestructive Measurement of Dry Film Thickness of Nonmagnetic Coatings Applied to a Ferrous Base

1.2 SUBMITTALS

The following shall be submitted in accordance with Section 01300 SUBMITTAL DESCRIPTIONS:

1.2.1 Porcelain Enamel Wall Panels

Manufacturer's catalog data.

1.2.2 Porcelain Enamel Wall Panels; Tile; Accessories; Marble Thresholds

Samples of sufficient size to show color range, pattern, type and joints.

1.3 DELIVERY AND STORAGE

Materials shall be delivered to the project site in manufacturer's original unopened containers with seals unbroken and labels and hallmarks intact. Materials shall be kept dry, protected from weather, and stored under cover.

1.4 ENVIRONMENTAL REQUIREMENTS

Ceramic tile work shall not be performed unless the ambient temperature is at least 50 degrees F and rising. Temperature shall be maintained above 50 degrees F while the work is being performed and for at least 3 days after completion of the work.

PART 2 PRODUCTS

2.1 PORCELAIN ENAMEL WALL PANELS

Porcelain enamel wall panels may be provided in lieu of ceramic tile for tub and shower walls as indicated. Porcelain panels shall be made from steel sheet and coated with porcelain enamel. Steel shall be special purpose enameling iron or steel sheets of low metalloid or carbon content, especially manufactured and processed for porcelain enamel units for architectural purposes. Panels shall be made from not lighter than 22-gauge steel sheets. The porcelain enamel shall be initially applied to all areas of each panel. An additional coating shall be applied as a cover coat on the surfaces normally visible after the installation. The surface abrasion index of the porcelain cover coat shall be 0.40 or higher when determined in accordance with ASTM C 448. Total thickness of each coating of porcelain enamel shall be not less than 0.004 inch and the two coatings shall have a thickness of 0.008 to 0.020 inch as determined in accordance with ASTM D 1186.

Porcelain panels shall be partially lined with molded polystyrene conforming to ASTM C 578. Each porcelain panel shall have an access panel, as indicated, made of the same material and finish as the panel, to cover and allow access to the valve to be installed.

2.2 TILE

Tile shall be standard grade conforming to ANSI A137.1. Containers shall be grade sealed.

2.2.1 Quarry Tile

Quarry tile and trim shall be unglazed with smooth surface. Tile shall be 6 x 6 x 1/2 inch and red in color, unless otherwise approved by the Contracting Officer.

2.2.2 Glazed Wall Tile

Glazed wall tile and trim shall be cushion edged with bright glaze. Tile shall be 4-1/4 by 4-1/4 inches and in colors as indicated.

2.3 SETTING, GROUTING, AND SEALING MATERIALS

Setting, grouting, and sealing materials shall be as recommended by the tile manufacturer.

2.4 MARBLE THRESHOLDS

Marble thresholds shall be of size required by drawings or conditions. Marble shall be Group A as classified by the MIA-01. Marble shall have a fine-sand-rubbed finish and shall be white, pink, or gray in color as approved by the Contracting Officer.

PART 3 EXECUTION

3.1 PREPARATORY WORK AND WORKMANSHIP

Surface to receive tile shall be inspected and shall conform to the requirements to ANSI A108.1 for surface conditions for the type setting bed specified and for workmanship.

3.2 GENERAL INSTALLATION REQUIREMENTS

Tile work shall not be started until roughing in for mechanical and electrical work has been completed and tested, and built-in items requiring membrane waterproofing have been installed and tested. Floor tile installation shall not be started in spaces requiring wall tile until after wall tile has been installed. Tile in colors and patterns indicated shall be applied in the area shown on the drawings. Tile shall be installed with the respective

surfaces in true even planes to the elevations and grades shown. Special shapes shall be provided as required for sills, jambs, recesses, offsets, external corners, and other conditions to provide a complete and neatly finished installation. Tile bases or coves shall be solidly backed with mortar.

3.3 INSTALLATION OF PORCELAIN ENAMEL WALL PANELS

Porcelain panels shall be part of the wall system which shall not be started until rough-in for mechanical, plumbing and electrical work has been completed and tested. The panel system shall be mechanically installed and shall include special shapes as required for sills, jambs, recesses, offsets, external corners, and other job conditions, so as to provide a complete and neatly finished installation. Clips supporting the panels shall be 20-gauge minimum thickness hot-dipped galvanized. Joints, seams and perimeter edges of porcelain panels shall be sealed with silicone sealant as recommended by the manufacturer.

3.4 INSTALLATION OF CERAMIC TILE

Tile shall be installed in accordance with ANSI A108.5, ANSI A108.10 and the tile manufacturer's recommendations.

3.5 INSTALLATION OF MARBLE THRESHOLDS

Thresholds shall be installed where indicated in a manner similar to that of the ceramic tile floor. Thresholds shall be the full width of the opening. Head joints at ends shall not exceed 1/4 inch in width and shall be grouted full as specified for ceramic tile.

3.6 CONTROL JOINTS

Joints shall be formed as indicated and sealed as specified in Section 07920A CAULKING AND SEALANTS. Control Joints shall be provided where backing materials change and over construction joints, control joints, and expansion joints in concrete slabs. Expansion joints shall extend through setting-beds and fill.

3.7 CLEANING AND PROTECTING

Upon completion, tile surfaces shall be thoroughly cleaned in accordance with ANSI A108.1 and manufacturer's recommendations. Tiled floor areas shall be covered with building paper before foot traffic is permitted over the finished tile floors. No foot traffic shall be allowed for at least 3 days. Board walkways shall be laid on tiled floors that are to be continuously used as passageways by workmen. Damaged or defective tiles shall be replaced.

END OF SECTION

SECTION 09510A

ACOUSTICAL CEILINGS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM C 635	(1991) Metal Suspension Systems for Acoustical Tile and Lay-In Panel Ceilings
ASTM C 636	(1991) Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels
ASTM E 90	(1990) Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions
ASTM E 119	(1988) Fire Tests of Building Construction and Materials
ASTM E 413	(1987) Rating Sound Insulation
ASTM E 1264	(1990) Standard Classification for Acoustical Ceiling Products

CEILINGS AND INTERIOR SYSTEMS CONSTRUCTION ASSOCIATION (CISCA)

CISCA AMA-I-II	(1967) Ceiling Sound Transmission Test by Two-Room Method

UNDERWRITERS LABORATORIES (UL)

UL-05	(1992) Fire Resistance Directory

1.2 GENERAL REQUIREMENTS

Acoustical treatment shall consist of sound controlling units mechanically mounted on a suspended ceiling system. The unit size, texture, finish, and color shall be as specified on the design drawing finish schedules for each rehabilitation property. The location and extent of acoustical treatment shall be as shown on the drawings as well.

1.3 SUBMITTALS

The following shall be submitted in accordance with Section 01300 SUBMITTAL DESCRIPTIONS:

1.3.1 Acoustical Ceiling System

Manufacturer's descriptive data and installation instructions.

1.3.2 Fire Resistive Ceilings; Ceiling Sound Transmission Class and Test

Test reports by an independent testing laboratory attesting that acoustical ceiling systems meet specified fire endurance requirements. Data attesting to conformance of the proposed system to Underwriters Laboratories, Inc. requirements for the fire endurance rating listed in UL-05 may be submitted in lieu of test reports.

1.3.3 Acoustical Units

Two samples of each type of acoustical unit showing texture, finish, and color.

1.4 DELIVERY AND STORAGE

Materials shall be delivered to the site in the manufacturer's original unopened containers with brand name and type clearly marked. Materials shall be stored in accordance with manufacturer's recommendations.

1.5 SCHEDULING

Interior finish work such as plastering, concrete and terrazzo work shall be complete and dry before installation. Mechanical, electrical, and other work above the ceiling line shall be completed and heating, ventilating, and air conditioning systems shall be installed and operating in order to maintain temperature and humidity as recommended by the manufacturer.

PART 2 PRODUCTS

2.1 ACOUSTICAL UNITS

Acoustical units shall conform to ASTM E 1264, Class A, and as indicated on the design drawing finish schedules.

2.2 SUSPENSION SYSTEM

Suspension system shall be as shown on drawings, and shall conform to ASTM C 635. Surfaces exposed to view shall be aluminum or steel with a factory-applied white baked-enamel finish. Wall molding shall have a flange of not less than 15/16 inch and shall be provided with outside corner caps. Inside corner caps shall be provided where, due to the configuration of the installation, they are needed to produce a workmanlike appearance.

2.3 HANGERS

Hangers shall be galvanized steel wire. Hangers and attachment shall support a minimum 300-pound ultimate vertical load without failure of supporting material or attachment.

2.4 ACCESS PANELS

Access panels shall match adjacent acoustical tiles and shall be designed and equipped with suitable framing and fastenings for removal and replacement without damage. Panel shall be not less than 12 by 12 inches or more than 12 by 24 inches. An identification plate of 0.032-inch thick aluminum, 3/4 inch in diameter, stamped with the letters "AP" and finished the same as the unit, shall be attached near one corner on the face of each access panel.

2.5 FIRE RESISTIVE CEILINGS

Acoustical ceiling systems indicated as fire resistive shall be rated for fire endurance as indicated when tested in accordance with ASTM E 119. Suspended ceiling shall have been tested with a specimen floor assembly representative of the indicated construction, including mechanical and electrical work within ceiling space openings for light fixtures, and air outlets, and access panels.

2.6 CEILING SOUND TRANSMISSION CLASS AND TEST

STC range of acoustical units, when required, shall be determined in accordance with CISCA AMA-I-II and reported in accordance with the appendix to ASTM E 90 for 11 frequency data or ASTM E 413 for 16 frequency data. Test ceiling shall be continuous at the partition and shall be assembled in the suspension system in the same manner that

the ceiling will be installed on the project. System shall be tested with all acoustical panels installed.

PART 3 EXECUTION

3.1 INSTALLATION

3.1.1 Suspension System

Suspension system shall be installed in accordance with ASTM C 636 and as specified herein. There shall be no hanger wires or other loads suspended from underside of steel decking.

3.1.2 Wall Molding

Wall molding shall be provided where ceilings abut vertical surfaces. Wall molding shall be secured not more than 3 inches from ends of each length and not more than 16 inches on centers between end fastenings. Wall molding springs shall be provided at each tile in semiexposed or concealed systems.

3.1.3 Ceiling Tiles

Ceiling tiles shall be installed in accordance with the approved installation instructions of the tile manufacturer. Edges of ceiling tiles shall be in close contact with metal supports, with each other, and in true alignment. Tile shall be arranged so that units less than one-half width are minimized. Panels in exposed-grid system shall be held in place with manufacturer's standard hold-down clips, if panels weigh less than 1 psf.

3.2 CEILING ACCESS PANELS

Ceiling access panels shall be located directly under the items to which access is required.

3.3 CLEANING

Following installation, dirty or discolored surfaces of acoustical units shall be cleaned and left free from defects. Units that are damaged or improperly installed shall be removed and new units provided as directed.

END OF SECTION

SECTION 09560A

WOOD STRIP FLOORING

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

MAPLE FLOORING MANUFACTURERS ASSOCIATION (MFMA)

MFMA-01 (1989) Spec Data Sheet; Wood Flooring, Maple

NATIONAL OAK FLOORING MANUFACTURERS ASSOCIATION (NOFMA)

NOFMA-01 (Jun 1989) Flooring Grading Rules, Oak, Beech, Birch, Hard Maple, Pecan

1.2 SUBMITTALS

The following shall be submitted in accordance with Section 01300 SUBMITTAL DESCRIPTIONS:

1.2.1 Installation

Manufacturer's descriptive data and installation instructions.

1.2.2 Strip Flooring

Two samples of each type of strip flooring.

1.3 DELIVERY AND STORAGE

Materials shall be delivered to the site in original unopened packages, bundles or containers and with all labels intact. Flooring shall be stored in fully covered, well ventilated areas and protected from extreme changes in temperature and humidity. Temperature and humidity in the storage area shall closely approximate the temperature and humidity of the rooms in which the flooring is to be installed.

1.4 ENVIRONMENTAL CONDITIONS

Rooms where wood flooring is to be installed shall be maintained at 65 to 80 degrees F starting not less than 3 days prior to beginning the installation of flooring. The temperature shall be maintained through the remainder of the contract period.

1.5 SCHEDULING

Strip flooring work shall be scheduled after any other work which would raise the moisture content of the flooring or damage the finished surface of the flooring.

PART 2 PRODUCTS

2.1 STRIP FLOORING

Strip flooring shall be 3/4-inch thick by 2-1/4 inches face width, kiln dried, continuous tongue and groove and of standard lengths. Beech and birch shall be second grade in accordance with NOFMA-01. Hard maple shall be second and better in accordance with MFMA-01. Red and white oak shall be select grade in accordance with NOFMA-01. Strip flooring shall be marked with the trademark of the grading agency.

2.2 NAILS

Nails shall be in accordance with strip flooring manufacturer's recommendations.

PART 3 EXECUTION

3.1 SURFACE CONDITIONS

Surfaces to receive flooring shall be clean, dry, and approved prior to start of installation.

3.2 INSTALLATION

Flooring shall be installed in accordance with the approved installation instructions of the manufacturer.

3.3 SANDING

Flooring shall be sanded to a smooth, even, uniform finish without burns. Edges not reached by the sander shall be finished with an edger or by hand methods. The final sanding shall be performed at a time and in a manner that will permit application of the first seal coat. The application of the first seal coat shall be completed within 8 hours after final sanding. The flooring shall be left clean and ready to receive the finishing materials.

3.4 PROTECTION

From the time of installation until final acceptance, flooring shall be protected from damage.

END OF SECTION

SECTION 09570A

HARDWOOD PARQUET FLOORING

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI APA 1 (1984) Floors and Flooring Mosaic-Parquet Hardwood Slat Flooring

1.2 SUBMITTALS

The following shall be submitted in accordance with Section 01300 SUBMITTAL DESCRIPTIONS:

1.2.1 Hardwood Parquet Flooring

Manufacturer's descriptive data and installation instructions.

1.3 DELIVERY AND STORAGE

Materials shall be delivered to the building site in the manufacturer's original unopened cartons and shall be protected against dampness during shipment and after delivery.

1.4 ENVIRONMENTAL REQUIREMENTS

Areas to receive parquet flooring shall be maintained at a temperature of 70 degrees F for 5 days before, during, and after application.

1.5 SCHEDULING

Parquet flooring work shall be scheduled after completion of any other work which would raise the moisture content of the flooring or damage the finished surface of the flooring.

PART 2 PRODUCTS

2.1 HARDWOOD PARQUET SLAT FLOORING

Hardwood parquet slat flooring shall conform to ANSI APA 1. Flooring shall be minimum 0.290 inch thick. Flooring shall be prefinished natural grade of red or white oak wood.

2.2 ADHESIVE

Adhesive shall be of a type recommended by flooring manufacturer and shall be compatible with field-applied finishes.

2.3 PRIMER

Primer shall be of a type recommended by flooring manufacturer.

2.4 WAX

Wax shall be of a type recommended by flooring manufacturer.

PART 3 EXECUTION

3.1 SURFACE CONDITIONS

Flooring shall not be installed on surfaces that are unsuitable and will prevent a proper installation. Concrete curing compounds or surface sealers shall have been entirely removed from the slabs.

3.2 INSTALLATION

Flooring shall be laid in a checkerboard pattern unless indicated otherwise and in accordance with the approved installation instructions of the manufacturer.

3.3 CLEANING AND PROTECTION

Finished floors shall be swept clean and all foot marks removed. From the time of installation until acceptance, flooring shall be protected from damage. A protective wax coat shall be applied in accordance with manufacturers recommendations.

END OF SECTION

SECTION 09650A

RESILIENT FLOORING

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

FEDERAL SPECIFICATIONS (FS)

FS L-F-475	(Rev A; Am 1; Int Am 3) Floor Covering Vinyl, Surface (Tile and Roll), with Backing
FS L-F-001641	(Basic; Am 2) Floor Covering Translucent or Transparent Vinyl Surface with Backing
FS P-F-430	(Rev C; Am 1) Finish, Floor, Water-Emulsion (For Use on Light Colored Floors)
FS P-W-155	(Rev C; Int Am 1) Wax, Floor, Water-Emulsion
FS SS-T-312	(Rev B; Int Am 1; Notice 1) Tile, Floor: Asphalt, Rubber, Vinyl, and Vinyl Compositions
FS SS-W-40	(Rev A; Int Am 1; Notice 1) Wall Base: Rubber, and Vinyl Plastic

1.2 SUBMITTALS

The following shall be submitted in accordance with Section 01300 SUBMITTAL DESCRIPTIONS:

1.2.1 Resilient Flooring and Accessories

Manufacturer's descriptive data and installation instructions. Cleaning and maintenance instructions shall be included.

1.2.2 Resilient Flooring and Accessories

Three samples of each color of vinyl-composition tile.

1.3 DELIVERY AND STORAGE

Materials shall be delivered to the building site in original unopened containers and shall be stored according to manufacturer's recommendations.

1.4 ENVIRONMENTAL REQUIREMENTS

Areas to receive resilient flooring shall be maintained at a temperature above 70 degrees F for 2 days before application, during application and 2 days after application. A minimum temperature of 55 degrees F shall be maintained thereafter.

1.5 SCHEDULING

Resilient flooring application shall be scheduled after the completion of other work which would damage the finished surface of the flooring.

PART 2 PRODUCTS

2.1 VINYL-COMPOSITION TILE

Vinyl-composition tile shall conform to FS SS-T-312, Type IV, Composition 1, asbestos-free, and shall be 12 inches square and 1/8-inch thick. Tile shall be of the color and pattern indicated.

2.2 WALL BASE

Wall base shall conform to FS SS-W-40, Type I or Type II, Style B. Base shall be 4-inches high, minimum 0.080-inch thick, color as required.

2.3 EDGE STRIPS

Edge strips shall be of vinyl plastic, 1-inch wide and of thickness to match flooring and shall be of color indicated.

2.4 ADHESIVE

Adhesive for flooring and wall base shall be as recommended by the flooring manufacturer.

2.5 POLISH

Polish shall conform to FS P-F-430 or FS P-W-155.

PART 3 EXECUTION

3.1 SURFACE CONDITIONS

Flooring shall be in a true, level plane, except where indicated as sloped. Concrete curing compounds, other than the type that does not adversely affect adhesion, shall be entirely removed from the slabs.

3.2 INSTALLATION OF VINYL-COMPOSITION TILE

Vinyl-composition tile flooring, edge strips, and wall base shall be installed in adhesive in accordance with the approved installation instructions of the manufacturer. Tile lines and joints shall be kept square, symmetrical, tight, and even. Flooring shall be cut to, and fitted around, all permanent fixtures. Edge strips shall be provided where indicated.

3.3 CLEANING

Immediately upon completion of the installation in a room or an area, flooring and adjacent surfaces shall be cleaned with an approved cleaner to remove surplus adhesive. No sooner than 5 days after installation, flooring shall be washed with an approved nonalkaline cleaning solution and rinsed thoroughly with clear cold water. No-wax floors shall then be finished according to manufacturer's recommendations. Other floors shall be given two coats of polish; after each polish coat floors shall be buffed to an even luster with an electric polishing machine.

END OF SECTION

SECTION 09680A

CARPET

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM E 648	(1988) Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source

CODE OF FEDERAL REGULATIONS (CFR)

CFR 16 Part 1630	(1975) Standard for the Surface Flammability of Carpet and Rugs

FEDERAL SPECIFICATIONS (FS)

FS L-C-001676	(Basic; Am 1) Cushion, Carpet and Rug, Virgin Urethane
FS ZZ-C-00811	(Rev B) Cushion, Carpet and Rug, Cellular Rubber
FS DDD-C-0095	(Rev A) Carpets and Rugs, Wool, Nylon, Acrylic, Modacrylic Polyester, Polypropylene
FS DDD-C-001023	(Basic; Am 1) Cushion, Carpet and Rug (Hair Felt and Rubber Coated Jutes and Animal Hair or Fiber)

1.2 SUBMITTALS

The following shall be submitted in accordance with Section 01300 SUBMITTAL DESCRIPTIONS:

1.2.1 Carpet and Accessories

Three copies of the manufacturer's printed installation instructions for the carpet, including procedures for an expert installation and covering preparation of substrate, seaming techniques, and recommended adhesives and tapes.

Certificates of compliance attesting that carpet and cushion materials conform to the standards specified.

Carpet and accessories samples are as follows:

a. Carpet: Two samples 12 inches by 18 inches of each carpet proposed for use, showing quality, pattern, and color specified.

b. Separate Carpet Cushion: Two samples, when tackless installation is specified.

c. Vinyl or Aluminum Moldings: Two pieces of each type at least 12 inches long.

d. Special Treatment Materials: Two samples showing system and installation method proposed.

Three copies of carpet manufacturer's maintenance instructions describing recommended type of cleaning equipment and material, spotting and cleaning methods and cleaning cycles.

1.3 DELIVERY AND STORAGE

Materials shall be delivered to the site in the manufacturer's original wrappings and packages clearly labeled with the manufacturer's name, brand name, size, and related information. Materials shall be stored in a clean, dry, well ventilated area, protected from damage and soiling, and maintained at a temperature above 60 degrees F for 2 days prior to installation.

PART 2 PRODUCTS

2.1 MATERIALS

2.1.1 Physical Requirements

Carpet shall be of tufted, woven, fusion-bonded, or knitted construction; free of visual blemishes, streaks, poorly dyed areas, and manufacturing defects. Carpet materials and treatments shall be nontoxic, reasonably nonallergenic, and free of other recognized health hazards. Carpet shall conform to the following:

a. Pile surface texture: As noted on design drawing finish schedule.

b. Pile fiber: As noted on design drawing finish schedule.

c. Pile weight: As noted on design drawing finish schedule.

d. Pile density: As noted on design drawing finish schedule.

e. Width: 12 feet minimum useable carpet.

f. Pattern and color: As indicated.

g. Pile height: As noted on design drawing finish schedule.

h. Surface texture: Plush-cut pile.

i. Tuft bind: 9-pound.

2.1.2 Backing Materials

Backing materials shall be those customarily used and accepted by the trade for each type of carpet tufted.

2.1.3 Static Control

Static control shall be provided to permanently control static buildup.

2.1.4 Critical Radiant Flux

Carpet shall comply with CFR 16 Part 1630. All carpet systems shall have a minimum average critical radiant flux of 0.25 watts per square centimeter when tested in accordance with ASTM E 648.

2.2 CARPET CUSHION

Carpet cushion shall be first quality, free of blemishes and other physical and manufacturing defects. Cushion materials and treatments shall be reasonably nonallergenic, nontoxic, and free of other recognized health hazards and shall conform to the following:

2.2.1 Attached Cushion

Attached cushion shall comply with FS DDD-C-0095 Class I or Class II rubber.

2.2.2 Separate Carpet Cushion

a. Coated jute and animal hair or fiber cushion shall comply with FS DDD-C-001023, Type 2, 39 oz. per sq. yd.

b. Rubber cushion shall comply with FS ZZ-C-00811, Type I, Class 1, 1/4 inch thick.

c. Urethane cushion shall comply with FS L-C-001676, Class 1, 3/8 inch thick.

2.3 ADHESIVES

Adhesive for installation of carpet shall be waterproof, nonflammable, and as recommended by the carpet manufacturer. Seam adhesive shall be waterproof, nonflammable, and nonstaining as recommended by the carpet manufacturer.

2.4 MOLDING

Molding shall be either aluminum or vinyl. Aluminum molding shall be a hammered surface, pinless clamp-down type, designed for the type of carpet being installed. Finish shall be natural color anodized. Floor flange shall be a minimum 1-1/2 inches wide and face shall be a minimum 5/8 inch wide. Vinyl molding shall be heavy-duty and designed for the type of carpet being installed. Floor flange shall be a minimum 2 inches wide. Color shall be as indicated.

2.5 TAPE

Tape for seams shall be as recommended by the carpet manufacturer.

2.6 TACKLESS STRIP

Water-resistant plywood strips with two or three rows of rust-resistant angular pins shall be used for tackless installations. For areas over 20 feet long, tackless strips with three rows of pins shall be used. Pins of the proper length shall be provided to penetrate through the carpet backing but not so long as to be seen from the surface or to be a safety hazard. Provide tackless strip 9/32 inch or 3/8 inch thick, suitable for the cushion thickness specified or as recommended by the carpet manufacturer.

PART 3 EXECUTION

3.1 SURFACE CONDITIONS

Carpet shall not be installed on surfaces that are unsuitable and will prevent a proper installation. Holes, cracks, depressions, or rough areas shall be repaired using material recommended by the carpet or adhesive manufacturer. Floor shall be free of any foreign materials and swept broom clean.

3.2 INSTALLATION

Installation shall be in accordance with the manufacturer's instructions.

3.2.1 Carpet

Carpet shall be installed with cushion and shall be smooth, uniform, and secure, with a minimum of seams. Side seams shall be run toward the light where practical and where such layout does not increase the number of seams. Breadths shall be installed parallel, with carpet pile in the same direction. Patterns shall be accurately matched. Cutouts, as at door jambs, columns and ducts shall be neatly cut and fitted securely. Seams at doorways shall be located parallel to and centered directly under doors. Seams shall not be made perpendicular to doors or at pivot points. Seams at changes in directions of corridors shall follow the wall line parallel to the carpet direction.

3.2.2 Seams

Seams shall be uniform, unnoticeable, and treated with a seam adhesive.

3.2.3 Molding

Edges of carpet meeting hard surface flooring shall be protected with molding. Installation shall be in accordance with the molding manufacturer's instructions.

3.3 CLEANING AND PROTECTION

3.3.1 Cleaning

After installation of the carpet; debris, scraps, and other foreign matter shall be removed. Soiled spots and adhesive shall be removed from the face of the carpet with appropriate spot remover. Protruding face yarn shall be cut off and removed. Carpet shall be vacuumed clean.

3.3.2 Protection

The installed carpet shall be protected from soiling and damage.

END OF SECTION

SECTION 10800A

TOILET ACCESSORIES

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

COMMERCIAL ITEM DESCRIPTIONS (CID)

CID A-A-2380	(Basic) Dispenser, Paper Towel
CID A-A-2398	(Basic) Curtain, Shower and Window Plastic
CID A-A-2668	(Basic) Dispenser, Toilet Paper, Cabinet

FEDERAL SPECIFICATIONS (FS)

FS DD-M-411	(Rev C) Mirrors, Glass
FS WW-H-1911	(Rev A) Holder, Toilet Paper (Single Roll)
FS WW-P-541/GEN	(Rev E; Am 1) Plumbing Fixtures
FS WW-P-541/8	(Rev B; Am 1) Plumbing Fixtures (Accessories, Land Use)

1.2 SUBMITTALS

The following shall be submitted in accordance with Section 01300 SUBMITTAL DESCRIPTIONS:

1.2.1 Finishes, Accessory Items

Manufacturers descriptive data indicating materials of construction, fasteners proposed for use for each type of wall construction, mounting instructions, and operation instructions.

1.3 GENERAL REQUIREMENTS

The locations and mounting heights of toilet accessories as specified herein shall be as indicated on the Design Drawings. Porcelain type, tile-wall accessories are specified in Section 09310A CERAMIC TILE. Each accessory item shall be complete with the necessary mounting plates, anchors, and fasteners. Concealed mounting plates shall be of sturdy construction with corrosion resistant surface.

1.3.1 Anchors and Fasteners

Anchors and fasteners shall be capable of developing a restraining force commensurate with the strength of the accessory to be mounted and shall be well suited for use with the supporting construction. Where exposed fasteners are permitted, they shall have oval heads and finish to match the accessory.

PART 2 PRODUCTS

2.1 FINISHES

Finishes on metal shall be provided as follows:

Metal	Finish
Stainless steel	No. 4 Satin finish
Carbon steel, copper alloy, and brass	Chromium plated, bright

2.2 ACCESSORY ITEMS

Accessory items shall conform to the respective specifications and other requirements specified below. All accessory items shall have a smooth finish.

2.2.1 Grab Bar (GB)

Grab bar shall conform to FS WW-P-541/GEN and FS WW-P-541/8, Type IV, Class 2, 1-1/4 inches OD Type 304 stainless steel. Grab bar shall be form and length as indicated. Exposed mounting flange shall have setscrew mounting holes concealed on the lip of the flange. Grab bar shall have a peened non-slip surface. Installed bars shall be mounted with a 1-1/2 inch minimum clearance from adjacent walls and shall be capable of withstanding a 500 pound vertical load without coming loose from the fastenings and without obvious permanent deformation.

2.2.2 Toilet Tissue Dispenser (TTD)

Toilet tissue dispenser shall conform to FS WW-H-1911, Type II, roller mounted on single continuous bracket.

2.2.3 Medicine Cabinet (MC)

Medicine cabinet shall conform to FS WW-P-541/GEN and FS WW-P-541/8, Type III. Width, height and depth of cabinet shall be as indicated on Design Drawings.

2.2.3.1 Swinging Door Cabinet, Class 2

Design of swinging door cabinet assembly including the lighting arrangement shall be as indicated. Assembly shall be recess mounted. Cabinet shall be located centrally behind the door. Mirror shall be provided on cabinet door.

2.2.4 Mirror, Glass (MG)

Glass mirror shall conform to FS DD-M-411, Class 2, Style C.

2.2.5 Shower Curtain Rods (SCR)

Shower curtain rods shall be Type 304 stainless steel 1-inch OD by 0.049-inch minimum straight to meet installation conditions.

2.2.6 Soap Holder (SH)

Soap holder shall conform to FS WW-P-541/GEN and FS WW-P-541/8, Type VI, Class 2, Type 304 stainless steel.

2.2.7 Towel Bar (TB)

Towel bar shall conform to FS WW-P-541/GEN and FS WW-P-541/8, Type IV, Class 1, stainless steel; length as required. Bar shall be minimum 3/4-inch diameter.

2.2.8 Towel Pin (TP)

Towel pin shall have concealed wall fastenings, pin integral with or permanently fastened to wall flange, maximum 4-inch projection, design consistent with design or other accessory items.

PART 3 EXECUTION

3.1 INSTALLATION

Toilet accessories shall be securely fastened to the supporting construction in accordance with the submittals. Accessories shall be protected from damage from the time of installation until acceptance.

END OF SECTION

SECTION 12390A

KITCHEN CABINETS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

BUILDERS HARDWARE MANUFACTURERS ASSOCIATION (BHMA)

BHMA A156.9	(1988) Cabinet Hardware

KITCHEN CABINET MANUFACTURERS ASSOCIATION (KCMA)

KCMA A161.1	(1990; Errata May 1991) Recommended Performance & Construction Standards for Kitchen and Vanity Cabinets

FEDERAL SPECIFICATION (FS)

FS MMM-A-130	(Rev B; Int Am 3) Adhesive, Contact

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA LD 3	(1991) High-Pressure Decorative Laminates

1.2 SUBMITTALS

The following shall be submitted in accordance with Section 01300 SUBMITTAL DESCRIPTIONS:

1.2.1 Wood Cabinets; Steel Cabinets, Miscellaneous Cabinets

Manufacturer's printed data, catalog cuts, and installation instructions. Samples to include the following:

a. Plastic laminate color samples, 2 inches by 3 inches.

b. Stain/color samples, 2 inches by 3 inches.

PART 2 PRODUCTS

2.1 CABINETS

2.1.1 General Requirements

Cabinets shall be wood frame type factory-manufactured, factory-finished of the manufacturer's standard sizes and of the type, design, and configuration indicated. Wall and base cabinets shall be of the same construction and same outside appearance. Cabinets shall be constructed as specified hereinafter or shall meet the requirements of KCMA A161.1. Evidence of conformance to KCMA A161.1 shall be provided and such evidence shall be the Kitchen Cabinet Manufacturers Association (KCMA) certification seal or certified copies of KCMA test reports. Both wall and base cabinet assemblies shall consist of individual units joined into continuous sections as indicated. Fastenings shall be accomplished to permit removal and replacement of individual units without affecting the remainder of the installation. Counters shall be provided with watertight sink rim. Drawers shall be removable and shall be equipped with position stops to avoid accidental complete withdrawals. Shelves shall be fixed or adjustable as indicated. Color as indicated on the finish schedule.

2.1.2 Finish

2.1.2.1 Wood Cabinets

Wood cabinets shall be provided with a factory-applied natural finish of a type standard with the manufacturer.

2.1.2.2 Steel Cabinets

Steel cabinets shall be provided with a factory-applied finish of two coats of synthetic enamel, baking quality, in accordance with the manufacturer's standard practice.

2.1.2.3 Plastic Laminates

Continuous sheets of longest lengths practicable shall be provided. Plastic laminate shall conform to the requirements of NEMA LD 3 and plastic laminate adhesive shall conform to FS MMM-A-130, Type I. Design, color, and finish shall be as specified in the finish schedule.

2.1.3 Hardware

Hardware shall conform to BHMA A156.9, shall be manufacturer's standard suitable for kitchen cabinet use, and shall include all miscellaneous hardware for a complete installation. Hardware and fastenings for doors and drawers with particle board cores shall be of the through-bolt type.

2.2 COUNTERTOPS AND BACKSPLASH

2.2.1 General

Countertop and backsplash shall be constructed of 3/4 inch thick plywood or particle board core and shall be cove type or fully formed typed. Backsplash shall be not less than 3-1/2 inches high. Edging and trim shall consist of plastic laminate cut and fitted to all exposed edges. End splashes constructed of 3/4-inch thick plywood or particle board core shall be supplied.

2.2.2 Sink Rims

Sink rims shall be of the corrosion resistant steel clamping type, sized to the sink, and a standard product of a manufacturer regularly producing this type of equipment.

2.2.3 Backer Sheets

Backer sheets of high pressure plastic laminate, Grade BK20 shall be applied to the underside of all core material.

2.3 OPTIONAL COMBINATION SINK UNIT

A combination sink-and-base cabinet unit may be furnished in lieu of the base cabinet and inset sink indicated, provided the combination unit affords equal facilities and space to those indicated; and provided the combination unit matches the adjacent units in materials and construction. The sink, with matching drainboards, shall be corrosion-resistant steel standard with the manufacturer and equipped with chromium-plated swinging-spout faucet, chromium-plated water-control valves, and chromium-plated brass cup strainer. The joints between the sink and drainboard, and between the drainboard and countertop, shall be made watertight and in accordance with manufacturer's recommendations.

2.4 MISCELLANEOUS CABINETS

Miscellaneous cabinets, including vanities, shall be furnished as indicated and shall be of the same materials and construction as the kitchen cabinets. Corner cabinets shall be equipped with notched shelving as indicated.

PART 3 EXECUTION

3.1 INSTALLATION

Cabinets shall be installed level, plumb, and true to line, and shall be attached to the walls or floors with suitable devices to securely anchor each unit. Countertops, accessories, and hardware shall be installed as indicated. The inner edge of sink cut-outs for laminated plastic tops shall be painted with a coat of semigloss enamel paint and sink flanges shall be set in a bed of sealant. Closer and filler strips and finish moldings shall be provided as required. Prior to final acceptance, doors shall be aligned, hardware adjusted, and cabinets left in a clean and neat condition.

END OF SECTION

SECTION 15400A

PLUMBING, PIPING DRAINAGE, WASTE, AND VENT

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 53	(1990b) Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless
ASTM A 74	(1987) Cast Iron Soil Pipe and Fittings
ASTM A 183	(1983; R 1990) Carbon Steel Track Bolts and Nuts
ASTM A 518	(1986; R 1991) Corrosion-Resistant High-Silicon Iron Castings
ASTM B 32	(1991) Solder Metal
ASTM B 42	(1992) Seamless Copper Pipe, Standard Sizes
ASTM B 43	(1991) Seamless Red Brass Pipe, Standard Sizes
ASTM B 306	(1988) Copper Drainage Tube (DWV)
ASTM B 370	(1988) Copper Sheet and Strip for Building Construction
ASTM C 564	(1988) Rubber Gaskets for Cast Iron Soil Pipe and Fittings
ASTM C 1053	(1990) Borosilicate Glass Pipe and Fittings for Drain, Waste, and Vent (DWV) Applications
ASTM D 2235	(1988) Solvent Cement for Acrylonitrile-Butadiene-Styrene (ABS) Plastic Pipe and Fittings
ASTM D 2564	(1991) Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Piping Systems

ASTM D 2661	(1991) Acrylonitrile-Butadiene-Styrene (ABS) Schedule 40 Plastic Drain, Waste, and Vent Pipe and Fittings
ASTM D 2665	(1991b) Poly(Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings
ASTM D 2822	(1991) Asphalt Roof Cement
ASTM D 2855	(1990) Making Solvent-Cemented Joints with Poly(Vinyl Chloride) (PVC) Pipe and Fittings
ASTM D 2996	(1988) Filament-Wound "Fiberglass" (Glass-Fiber-Reinforced Thermosetting-Resin) Pipe
ASTM D 3138	(1990) Solvent Cements for Transition Joints Between Acrylonitrile-Butadiene-Styrene (ABS) and Poly(Vinyl Chloride) (PVC) Non-pressure Piping Components
ASTM D 3139	(1989) Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals
ASTM D 3212	(1989) Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals
ASTM D 4101	(1982; R 1988) Propylene Plastic Injection and Extrusion Materials

AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)

ASME A112.14.1	(1975) Backwater Valves
ASME A112.21.1M	(1991) Floor Drains
ASME A112.21.2M	(1991) Roof Drains
ASME A112.36.2M	(1983) Cleanouts
ASME B1.20.1	(1983) Pipe Threads, General Purpose (Inch)
ASME B16.3	(1985) Malleable Iron Threaded Fittings, Classes 150 and 300
ASME B16.4	(1985) Cast Iron Threaded Fittings Class 125 and 250
ASME B16.12	(1983) Cast Iron Threaded Drainage Fittings

ASME B16.15	(1985) Cast Bronze Threaded Fittings, Classes 125 and 250
ASME B16.18	(1984) Cast Copper Alloy Solder Joint Pressure Fittings
ASME B16.21	(1978) Nonmetallic Flat Gaskets for Pipe Flanges
ASME B16.23	(1984) Cast Copper Alloy Solder Joint Drainage Fittings DWV
ASME B16.24	(1979) Bronze Pipe Flanges and Flanged Fittings, Class 150 and 300
ASME B16.29	(1986) Wrought Copper and Wrought Copper Alloy Solder Joint Drainage Fittings - DWV

AMERICAN WATER WORKS ASSOCIATION (AWWA)

AWWA C105	(1988) Polyethylene Encasement for Ductile-Iron Piping for Water and Other Liquids
AWWA C203	(1986) Coal-Tar Protective Coatings and Linings for Steel Water Pipelines Enamel and Tape - Hot-Applied
AWWA C606	(1987) Grooved and Shouldered Joints

CAST IRON SOIL PIPE INSTITUTE (CISPI)

CISPI Std 301	(1990) Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications
CISPI Std HSN	(1985) Neoprene Rubber Gaskets for Hub and Spigot Cast Iron Soil Pipe and Fittings

FEDERAL SPECIFICATIONS (FS)

FS QQ-C-40	(Basic; Am 2; Notice 1) Calking: Lead Wool and Lead Pig
FS QQ-L-201	(Rev F; Am 2) Lead Sheet
FS TT-S-00230	(Rev C) Sealing Compound, Elastomeric Type, Single Component (for Calking, Sealing, and Glazing in Buildings and Other Structures)

FS TT-S-001543	(Rev A) Sealing Compound: Silicone Rubber Base (for Calking, Sealing, and Glazing in Buildings and Other Structures)
FS WW-C-440	(Rev B; Am 2) Clamps, Hose, (Low-Pressure)

MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVE AND FITTINGS INDUSTRY (MSS)

MSS SP-58	(1988) Pipe Hangers and Supports - Materials, Design and Manufacture
MSS SP-69	(1991) Pipe Hangers and Supports - Selection and Application
MSS SP-73	(1991) Brazing Joints for Copper and Copper Alloy Pressure Fittings

MILITARY SPECIFICATION (MS)

MS MIL-T-27730	(Rev A) Tape, Antiseize, Polytetrafluoroethylene, With Dispenser

NATIONAL ASSOCIATION OF PLUMBING-HEATING-COOLING CONTRACTORS (NAPHCC)

NAPHCC-01	(1990; Supple 1991) National Standard Plumbing Code

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 90A	(1989) Installation of Air Conditioning and Ventilating Systems

NATIONAL SANITATION FOUNDATION (NSF)

NSF Std 14	(1965; Rev Dec 1988) Plastic Piping System Components and Related Materials

PLUMBING AND DRAINAGE INSTITUTE (PDI)

PDI G-101	(1985) Testing and Rating Procedures for Grease Interceptors

1.2 GENERAL REQUIREMENTS

1.2.1 Standard Products

Materials and equipment shall be the standard products of a manufacturer regularly engaged in the manufacture of the products.

Items of equipment shall essentially duplicate equipment that has been in satisfactory use at least 2 years prior to bid opening.

1.2.2 Verification of Dimensions

The Contractor shall become familiar with details of the work, verify dimensions in the field, and advise the Contracting Officer of any discrepancy before performing any work.

1.2.3 Code

All plumbing work shall be in accordance with NAPHCC-01, unless otherwise stated.

1.3 SUBMITTALS

The following shall be submitted in accordance with Section 01300 SUBMITTAL DESCRIPTIONS:

1.3.1 Tests, Flushing and Sterilization

Test reports in booklet form showing all field tests performed to adjust each component and all field tests performed to prove compliance with the specified performance criteria. Each test report shall indicate the final position of controls.

1.3.2 Materials and Equipment

Where materials or equipment are specified to comply with requirements of AGA, or ASME, proof of such compliance. The label or listing of the specified agency will be acceptable evidence. In lieu of the label or listing, a written certificate may be submitted from an approved, nationally recognized testing organization equipped to perform such services, stating that the items have been tested and conform to the requirements and testing methods of the specified agency. Where equipment if specified to conform to requirements of the ASME Boiler and Pressure Vessel Code, the design, fabrication, and installation shall conform to the code.

1.3.3 Bolts

Written certification that the bolts furnished comply with the requirements of this specification, provided by the bolt manufacturer. The certification shall include illustrations of product-required markings, the date of manufacture, and the number of each type of bolt to be furnished based on this certificate.

PART 2 PRODUCTS

2.1 MATERIALS

2.1.1 Pipe

Pipe fittings shall be compatible with the applicable pipe materials. Pipe threads (except dry seal) shall conform to ASME B1.20.1. Grooved pipe couplings and fittings shall be of the same manufacture. Materials or equipment containing lead shall not be used in any potable water system.

Pipe materials shall be in accordance with Tables I and II.

2.1.2 Hubless Pipe

Hubless cast-iron soil pipe shall not be installed under concrete floor slabs or in crawl spaces below kitchen floors.

2.1.3 Plastic Pipe

Plastic pipe shall not be installed under concrete floor slabs, or in air plenums. Plastic pipe shall not be installed in a pressure piping system in buildings greater than three stories including any basement levels. Plastic pipe, fittings, and solvent cement shall meet NSF Std 14 and be NSF listed for service intended. Plastic pipe, fittings, and solvent cement used for potable hot and cold water service shall bear the NSF seal "NSF-PW". Polypropylene pipe shall conform to dimensional requirements for Schedule 40, Iron Pipe Size.

2.1.4 Pipe Joint Materials

Joints and gaskets materials shall conform to the following:

a. Caulking Lead: FS QQ-C-40, Type I.

b. Coupling for Cast-Iron Pipe: ASTM A 74, AWWA C606.

c. Coupling for Steel Pipe: AWWA C606.

d. Nonmetallic Flange Gaskets for Flanges: ASME B16.21.

e. Neoprene Gaskets for Hub and Cast-Iron Pipe and Fittings: CISPI Std HSN.

f. Metal Solder: ASTM B 32, 95-5, tin-antimony.

g. Silver Brazing Joints for Wrought and Cast Solder-Joint Fittings: MSS SP-73.

h. PTFE Tape, for use with Threaded Metal or Plastic Pipe: MS MIL-T-27730.

i. Rubber Gaskets for Cast-Iron Soil-Pipe and Fittings: ASTM C 564.

j. Flexible Elastomeric Seals: ASTM D 3139 or ASTM D 3212.

k. Bolts and Nuts for Grooved Pipe Couplings: Heat-treated carbon steel, ASTM A 183.

l. Solvent Cement for Transition Joints between ABS and PVC Nonpressure Piping Components: ASTM D 3138.

m. Plastic Solvent Cement for ABS Plastic Pipe: ASTM D 2235.

n. Plastic Solvent Cement for PVC Plastic Pipe: ASTM D 2564 and ASTM D 2855.

2.1.5 Miscellaneous Materials

Miscellaneous materials shall conform to the following:

a. Copper, Sheet and Strip for Building Construction: ASTM B 370.

b. Lead, Sheet: FS QQ-L-201, Grade B.

c. Asphalt Roof Cement: ASTM D 2822.

d. Hose Clamps: FS WW-C-440.

e. Metallic Cleanouts: ASME A112.36.2M.

f. Coal-Tar Protective Coatings and Linings for Steel Water Pipelines: AWWA C203.

g. Polyethylene Encasement for Ductile-Iron Piping: AWWA C105.

2.1.6 Pipe Insulation Material

Insulation shall be as specified on the design drawings.

2.2 PIPE HANGERS, INSERTS, AND SUPPORTS

Pipe hangers, inserts, and supports shall conform to MSS SP-58 and MSS SP-69.

2.3 BACKWATER VALVES

Backwater valves shall be installed where indicated and shall conform to ASME A112.14.1. Backwater valves shall be either separate from the floor drain or a combination floor drain, P-trap, and backwater valve, as shown. Valves shall have cast-iron bodies with cleanouts large enough to permit removal of interior parts. Valves shall be of the flap type, hinged or pivoted, with revolving disks. Hinge pivots, disks, and seats shall be nonferrous metal. Disks shall be slightly open in a no-flow no-backwater condition. Cleanouts shall extend to finished floor and be fitted with threaded countersunk plugs.

2.4 DRAINS

2.4.1 Floor and Shower Drains

Floor and shower drains shall conform to ASME A112.21.1M. Drains installed in connection with waterproofed floors or shower pans shall be equipped with bolted-type device to securely clamp flashing.

2.4.2 Area Drains

Drains shall conform to ASME A112.21.1M.

2.5 SHOWER PAN

Shower pan may be lead, copper, or nonmetallic material.

2.5.1 Sheet Lead

Sheet lead shall be 6-pound weight, except that 4-pound sheet lead may be used for each pan installed without joints or seams other than corner seams.

2.5.2 Sheet Copper

Sheet copper shall be 16-ounce weight.

2.5.3 Nonplasticized Chlorinated Polyethylene Shower Pan Material

Material shall be sheet form. The material shall be 0.040-inch minimum thickness of nonplasticized chlorinated polyethylene.

2.5.4 Nonplasticized Poly(Vinyl Chloride) (PVC) Shower Pan Material

Material shall consist of a plastic waterproofing membrane in sheet form. The material shall be 0.040-inch minimum thickness of nonplasticized PVC.

2.6 TRAPS

Unless otherwise specified herein, traps shall be copper-alloy adjustable tube type with slip joint inlet and swivel. Traps shall be without a cleanout. Tubes shall be not less than 20-gauge copper alloy with walls 0.032-inch thick within commercial tolerances, except on the outside of bends where the thickness may be reduced slightly in manufacture by usual commercial methods. Inlets shall have rubber washer and copper alloy nuts for slip joints above the discharge level. Swivel joints shall be below the discharge level and shall be of metal-to-metal or metal-to-plastic type as required for the application. Nuts shall have flats for wrench grip. Outlets shall have internal pipe thread, except that when required for the application, the outlets shall have sockets for solder-joint connections. The depth of the water seal shall be not less than 2 inches. The interior diameter shall be not more than 1/8 inch over or under the nominal size, and interior surfaces shall be reasonably smooth throughout. A copper alloy "P" trap assembly consisting of an adjustable "P" trap and treaded trap wall nipple with cast brass wall flange shall be provided for lavatories. The assembly shall be a standard manufactured unit and may have a rubber-gasketed swivel joint.

PART 3 EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

All piping located in air plenums shall conform to NFPA 90A requirements. Water and drainage pipe shall be extended 5 feet outside the building, unless otherwise indicated. Piping shall be connected to the exterior service lines or capped or plugged, if the exterior service is not in place. Sewer and water pipes shall be laid in separate trenches, except when otherwise shown. All exterior underground utilities shall be at least 12 inches below the average local frost depth or as indicated on the drawings. If trenches are closed or the pipes are otherwise covered before being connected to the service lines, the location of the end of each plumbing utility shall be marked with a stake or other acceptable means. Valves shall be installed horizontal or above ground.

3.1.1 Soil, Waste, Drain, and Vent Piping

No joint shall be located within 6 inches of any floor. Metallic pipe shall be used through penetrations to a point at least 6 inches on both sides of the penetration or to the required point of termination above a roof.

3.1.2 Joints

Installation of pipe and fittings shall be made in accordance with the manufacturer's recommendations. Threaded joints shall have American Standard taper pipe threads conforming to ASME B1.20.1. Only male pipe threads shall be coated with graphite or with an approved graphite compound, or with an inert filler and oil, or shall have a polytetrafluoroethylene tape applied.

3.1.2.1 Copper Tube

Joints for copper tubing shall be made with soldered or brazed fittings. Solder shall consist of 95 percent tin and 5 percent antimony. Tubes shall be cut square and reamed to remove burrs. Outside surface of the tube where engaged in the fitting, and inside surface of the fitting in contact with the tube, shall be cleaned with an abrasive material before soldering. Care shall be taken to prevent annealing of tube and fittings when making connections. Solder joints shall be made with flux and wire form or paste-type solder. The flux for solder shall be mildly corrosive liquid or petroleum-based paste containing chlorides of zinc and ammonia. Core solder shall not be used. Excess solder shall be wiped from joint before solder hardens. Joints in copper tube 2-1/2 inches and larger shall be made with heat applied uniformly around the entire circumference of the tube and fittings by a multiflame torch. Excess solder flux on the inside surface of the joint shall be avoided. Copper tube joints under floor slabs shall be brazed.

3.1.2.2 Copper Tube Extracted Joint

An extracted mechanical joint may be made in copper tube. Joint shall be produced with an appropriate tool by drilling a pilot hole and drawing out the tube surface to form a collar having a minimum height of three times the thickness of the tube wall. To prevent the branch tube from being inserted beyond the depth of the extracted joint, dimpled depth stops shall be provided. Also branch tube shall be notched for proper penetration into fitting to ensure a free flow joint. Extracted joints shall be brazed in accordance with NAPHCC-01 using B-Cup series filler metal in accordance with MSS SP-73. Soldered joints will not be permitted.

3.1.2.3 Plastic Pipe

Threaded joints shall be used only where required for disconnection and inspection.

ABS pipe shall have joints made with solvent cement. PVC and CPVC pipe shall have joints made with solvent cement elastomeric, threading (threading of Schedule 80 Pipe is allowed only where required for disconnection and inspection; threading of Schedule 40 Pipe is not allowed), or mated flanged. PB pipe shall joints made copper or brass fittings of the compression or mechanical type for 3/4 inch and 1 inch sizes and the heat type socket-fusion fittings for 1 inch, 1-1/4 inch, 1-1/2 inch, and 2 inch sizes.

3.1.3 Dissimilar Pipe Materials

Connections between ferrous and copper pipe shall be made with dielectric unions or flanges. Connecting joints between plastic and metallic pipe shall be made with transition fitting for the specific purpose.

3.1.4 Pipe Sleeves and Flashing

Pipe sleeves shall be furnished and set in their proper and permanent location.

3.1.4.1 Sleeve Requirements

Pipes passing through concrete or masonry walls or concrete floors or roofs shall be provided with pipe sleeves fitted into place at the time of construction. Sleeves shall not be required for cast-iron soil pipe passing through concrete slab on grade, except where penetrating a membrane waterproof floor. A modular mechanical type sealing assembly may be installed in lieu of a waterproofing clamping flange and caulking and sealing of annular space between pipe and sleeve. The seals shall consist of interlocking synthetic rubber links shaped to continuously fill the annular space between the pipe and sleeve with corrosion-protected carbon steel bolts, nuts, and pressure plates. The links shall be loosely assembled with bolts to form a continuous rubber belt around the pipe with a pressure plate under each bolt head and each nut. After the seal assembly is properly positioned in the sleeve, tightening of the bolt shall cause the rubber sealing elements to expand and provide a watertight seal between the pipe and the sleeve. Each seal assembly shall be sized as recommended by the manufacturer to fit the pipe and sleeve involved. Sleeves shall not be installed in structural members, except where indicated or approved. Rectangular and square openings shall be as detailed. Each sleeve shall extend through its respective floor, or roof, and shall be cut flush with each surface, except for special circumstances. Pipe sleeves passing through floors in wet areas such as mechanical equipment rooms, lavatories, kitchens, and other plumbing fixture areas shall extend a minimum of 4 inches above the finished floor. Unless otherwise indicated, sleeves shall be of a size to provide a minimum of 1/4-inch clearance all-around between bare pipe and inside of sleeve or between jacket over insulation and sleeves. Sleeves in bearing walls shall be steel pipe or cast-iron pipe. Sleeves for membrane waterproof floors shall be steel pipe, cast-iron pipe, or plastic pipe. Membrane clamping devices shall be provided on pipe sleeves for waterproof floors. Sleeves in nonbearing walls or ceilings may be steel pipe, cast-iron pipe, galvanized sheet metal with lock-type longitudinal seam, or moisture-resistant fiber or plastic. Plastic sleeves shall not be used in nonbearing fire walls, roofs, or floor/ceilings. Pipes passing through sleeves in concrete floors over crawl spaces shall be sealed as specified above. The annular space between pipe and sleeve or between jacket over insulation and sleeve shall not be sealed for interior walls which are not designated as fire rated.

3.1.4.2 Flashing Requirements

Pipes passing through roof or floor waterproofing membrane shall be installed through a 4-pound lead flashing or a 16-ounce copper flashing, each within an integral skirt or flange. Flashing shall be suitably formed, and the skirt or flange shall extend not less than 8 inches from the pipe and shall be set over the roof or floor membrane in a solid coating of bituminous cement. The flashing shall extend up the pipe a minimum of 10 inches. For cleanouts, the flashing shall be turned down into the hub and caulked after placing the ferrule. Pipes passing through pitched roofs shall be flashed, using lead or copper flashing, with an adjustable integral flange of adequate size to extend not less than 8 inches from the pipe in all directions and lapped into the roofing to provide a watertight seal. The annular space between the flashing and the bare pipe or between the flashing and the metal-jacket-covered insulation shall be sealed as indicated. Flashing for dry vents shall be turned down into the pipe to form a waterproof joint. Pipes, up to and including 10 inches in diameter, passing through roof or floor waterproofing membrane may be installed through a cast-iron sleeve with caulking recess, anchor lugs, flashing-clamp device, and pressure ring with brass bolts. Flashing shield shall be fitted into the sleeve clamping device. Pipes passing through wall waterproofing membrane shall be sleeved as described above. In addition, a waterproofing clamping flange shall be installed.

3.1.4.3 Waterproofing

Waterproofing at floor-mounted water closets shall be accomplished by forming a flashing guard from lead or soft-tempered sheet copper. The center of the sheet shall be perforated and turned down approximately 1-1/2 inches to fit between the outside diameter of the drainpipe and the inside diameter of the cast-iron or steel pipe sleeve. The turned-down portion of the flashing guard shall be embedded in sealant to a depth of approximately 1-1/2 inches; then the sealant shall be finished off flush to floor level between the flashing guard and drainpipe. The flashing guard of lead or sheet copper shall extend not less than 8 inches from the drainpipe and shall be lapped between the floor membrane in a solid coating of bituminous cement. If cast-iron water closet floor flanges are used, the space between the pipe sleeve and drainpipe shall be sealed with sealant and the flashing guard shall be upturned approximately 1-1/2 inches to fit the outside diameter of the drainpipe and the inside diameter of the water closet floor flange. The upturned portion of the sheet fitted into the floor flange shall be caulked with oakum and lead to form a seal.

3.1.4.4 Optional Counterflashing

Instead of turning the flashing down into a dry vent pipe, or caulking and sealing the annular space between the pipe and flashing or metal-jacket-covered insulation and flashing, counterflashing may be accomplished by utilizing the following:

a. A standard roof coupling for threaded pipe up to 6 inches in diameter.

b. A tack-welded or banded-metal rain shield around the pipe.

3.1.5 Supports

3.1.5.1 General

Hangers supporting piping 2 inches and larger shall be fabricated to permit adequate adjustment after erection.

3.1.5.2 Pipe Hangers, Inserts, and Supports

Pipe hangers, inserts and supports installation shall conform to MSS SP-58 and MSS SP-69, except as modified herein.

a. Types 5, 12, and 26 shall not be used.

b. Type 18 inserts shall be secured to concrete forms before concrete is placed. Continuous inserts which allow more adjustment may be used if they otherwise meet the requirements for type 18 inserts.

c. Type 19 and 23 C-clamps shall be torqued per MSS SP-69 and have both locknuts and retaining devices, furnished by the manufacturer. Field-fabricated C-clamp bodies or retaining devices are not acceptable.

d. Type 20 attachments used on angles and channels shall be furnished with an added malleable-iron heel plate or adapter.

e. Type 24 may be used only on trapeze hanger systems or on fabricated frames.

f. Horizontal pipe supports shall be spaced as specified in MSS SP-69 and a support shall be installed not over one foot from the pipe fitting joint at each change in direction of the piping. Pipe supports shall be spaced not over 5 feet apart at valves. Use 120 degrees F for PVC pipe as operating temperatures in determining hanger spacing for PVC pipe.

g. Vertical pipe shall be supported at each floor, except at slab-on-grade, and at intervals of not more than 15 feet, not more than 8 feet from end of risers, and at vent terminations.

3.1.6 Pipe Cleanouts

Pipe cleanouts shall be the same size as the pipe except that cleanout plugs larger than 4 inches will not be required. A cleanout installed in connection with cast-iron soil pipe shall consist of a long-sweep 1/4 bend or one or two 1/8 bends extended to the place shown. An extra-heavy cast-brass brass or cast-iron ferrule with countersunk cast-brass head screw plug shall be caulked into the hub of the fitting and shall be flush with the floor. Cleanouts in connection with other pipe, where indicated, shall be T-pattern, 90-degree branch drainage fittings with cast-brass screw plugs, except plastic plugs shall be installed in plastic pipe. Plugs shall be the same size as the pipe up to and including 4 inches. Cleanout tee branches with screw plug shall be installed at the foot of soil and waste stacks, at the foot of interior downspouts, on each connection to building storm drain where interior downspouts are indicated, and on each building drain outside the building. Cleanout tee branches may be omitted on stacks in single-story buildings with slab-on-grade construction or where less than 18 inches of crawl space is provided under the floor. Cleanouts on pipe concealed in partitions shall be provided with chromium plated bronze, nickel bronze, nickel brass or stainless steel flush type access cover plates. Round access covers shall be provided and secured to plugs with securing screw. Square access covers may be provided with matching frames, anchoring lugs and cover screws. Cleanouts in finished walls shall have access covers and frames installed flush with the finished wall. Cleanouts installed in finished floors subject to foot traffic shall be provided with a chrome-plated cast brass, nickel brass, or nickel bronze cover secured to the plug or cover frame and set flush with the finished floor. Heads of fastening screws shall not project above the cover surface. Where cleanouts are provided with adjustable heads, the heads shall be cast iron or plastic.

3.2 FIXTURES

3.2.1 Fixture Connections

Where space limitations prohibit standard fittings in conjunction with the cast-iron floor flange, special short-radius fittings shall be provided. Connections between earthenware fixtures and flanges on soil pipe shall be made gastight and watertight with a closet-setting compound or neoprene gasket and seal. Use of natural rubber gaskets or putty will not be permitted. Fixtures with outlet flanges shall be set the proper distance from floor or wall to make a first-class joint with the closet-setting compound or gasket and fixture used.

3.2.2 Sight Drains

Sight drains shall be installed so that the indirect waste will terminate 2 inches above the flood rim of the funnel to provide an acceptable air gap.

3.2.3 Traps

Each trap shall be placed as near the fixture as possible, and no fixture shall be double-trapped. Traps installed on cast-iron soil pipe shall be cast iron. Traps installed on steel pipe or copper tubing shall be recess-drainage pattern, or brass-tube type. Traps for acid-resisting waste shall be of the same material as the pipe.

3.2.4 Shower Pans

The floor of each individual shower, the shower-area portion of combination shower and drying room, and the entire shower and drying room where the two are not separated by curb or partition, shall be made watertight with a shower pan fabricated in place. The shower pan material shall be cut to size and shape of the area indicated, in one piece to the maximum extent practicable, allowing a minimum of 6 inches for turnup on walls or partitions, and shall be folded over the curb with an approximate return of 1/4 of curb height. The upstands shall be placed behind any wall or partition finish. Subflooring shall be smooth and clean, with nailheads driven flush with surface, and shall be sloped to drain. Shower pans shall be clamped to drains with the drain clamping ring.

3.3 ESCUTCHEONS

Escutcheons shall be provided at finished surfaces where bare or insulated piping, exposed to view, passes through floors, walls, or ceilings, except in boiler, utility, or equipment rooms. Escutcheons shall be fastened securely to pipe or pipe covering and shall be satin-finish, corrosion-resisting steel, polished chromium-plated zinc alloy, or polished chromium-plated copper alloy. Escutcheons shall be either one-piece or split-pattern, held in place by internal spring tension or setscrew.

3.4 TESTS, FLUSHING, AND STERILIZATION

3.4.1 Plumbing System

The plumbing system shall be tested in accordance with NAPHCC-01.

3.4.2 Defective Work

If inspection or test shows defects, such defective work or material shall be replaced or repaired as necessary and inspection and tests shall be repeated. Repairs to piping shall be made with new materials. No caulking of screwed joints or holes will be acceptable.

TABLE I

PIPE AND FITTING MATERIALS FOR
DRAINAGE, WASTE, AND VENT PIPING SYSTEMS

SERVICE

Item No.	Pipe and Fitting Materials	A	B	C	D	E	F
1	Cast iron soil pipe and fittings, hub and spigot, ASTM A 74 with compression gaskets	X	X	X	X	X	
2	Cast iron soil pipe and fittings hubless, CISPI Std 301		X		X	X	
3	Cast iron drainage fittings, threaded, ASME B16.12 for use with Item 6		X		X	X	
4	Cast iron screwed fittings (threaded) ASME B16.4 for use with Item 6				X	X	
5	Malleable-iron threaded fittings, galvanized ASME B16.3 for use with Item 6				X	X	
6	Steel pipe, seamless galvanized, ASTM A 53, Type S, Grade B		X		X	X	
7	Seamless red brass pipe, ASTM B 43				X	X	
8	Bronze flanged fittings, ASME B16.24 for use with Items 7 and 10				X	X	
9	Cast copper alloy solder joint pressure fittings, ASME B16.18 for use with Item 10				X	X	

Item No.	Pipe and Fitting Materials	A	B	C	D	E	F
10	Seamless copper pipe, ASTM B 42				X	X	
11	Cast bronze threaded fittings, ASME B16.15				X	X	
12	Copper drainage tube, (DWV), ASTM B 306	X*	X	X*	X	X	
13	Wrought copper and wrought copper alloy solder-joint drainage fittings. ASME B16.29	X	X	X	X	X	
14	Cast copper alloy solder joint drainage fittings, DWV, ASME B16.23	X	X	X	X	X	
15	Acrylonitrile-Butadiene-Styrene (ABS) plastic drain, waste, and vent pipe and fittings ASTM D 2661	X	X		X		
16	Polyvinyl Chloride plastic drain, waste and vent pipe and fittings, ASTM D 2665	X	X		X	X	
17	Process glass pipe and fittings, ASTM C 1053						X
18	High-silicon content cast iron pipe and fittings (hub and spigot, and mechanical joint), ASTM A 518				X	X	
19	Polypropylene (PP) waste pipe and fittings, ASTM D 4101						X

Item No.	Pipe and Fitting Materials	A	B	C	D	E	F
20	Filament-wound reinforced thermosetting resin (RTRP) pipe, *ASTM D 2996*						X

A - Underground Building Soil, Waste and Storm Drain

B - Aboveground Soil, Waste, Drain In Buildings
C - Underground Vent
D - Aboveground Vent
E - Interior Rainwater Conductors Aboveground
F - Corrosive Waste And Vent Above And Belowground
* - Hard Temper

END OF SECTION

SECTION 15400B

PLUMBING, FIXTURES

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AIR CONDITIONING AND REFRIGERATION INSTITUTE (ARI)

ARI 1010	(1984) Drinking Fountains and Self-Contained, Mechanically-Refrigerated Drinking-Water Coolers

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI A117.1	(1986) Providing Acessibility and Usability for Physically Handicapped People

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 47	(1984;R 1989) Ferritic Malleable Iron Castings
ASTM A 74	(1987) Cast Iron Soil Pipe and Fittings
ASTM A 183	(1983; R 1990) Carbon Steel Track Bolts and Nuts
ASTM A 536	(1984) Ductile Iron Castings
ASTM B 32	(1989) Solder Metal
ASTM B 370	(1988) Copper Sheet and Strip for Building Construction
ASTM C 564	(1988) Rubber Gaskets for Cast Iron Soil Pipe and Fittings
ASTM D 2000	(1990) Rubber Products in Automotive Applications
ASTM D 2235	(1988) Solvent Cement for Acrylonitrile-Butadiene-Styrene (ABS) Plastic Pipe and Fittings

ASTM D 2564	(1991) Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Piping Systems
ASTM D 2855	(1990) Making Solvent-Cemented Joints with Poly(Vinyl Chloride) (PVC) Pipe and Fittings
ASTM D 3138	(1990) Solvent Cements for Transition Joints Between Acrylonitrile-Butadiene-Styrene (ABS) and Poly(Vinyl Chloride) (PVC) Non-pressure Piping Components
ASTM D 3139	(1989) Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals
ASTM D 3212	(1989) Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals
ASTM F 493	(1989) Solvent Cements for Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe and Fittings

AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)

ASME A112.6.1M	(1988) Supports for Off-the-Floor Plumbing Fixtures for Public Use
ASME A112.21.1M	(1980) Floor Drains
ASME A112.21.2M	(1983) Roof Drains
ASME B1.20.1	(1983) Pipe Threads, General Purpose (Inch)
ASME B16.21	(1978) Nonmetallic Flat Gaskets for Pipe Flanges

AMERICAN SOCIETY OF SANITARY ENGINEERING (ASSE)

ASSE 1006	(1986) Residential Use (Household) Dishwashers
ASSE 1012	(1978) Backflow Preventers with Intermediate Atmospheric Vent
ASSE 1037	(1990) Pressurized Flushing Devices for Plumbing Fixtures

AMERICAN WATER WORKS ASSOCIATION (AWWA)

AWWA C606	(1987) Grooved and Shouldered Joints

CAST IRON SOIL PIPE INSTITUTE (CISPI)

CISPI STD HSN	(1985) Neoprene Rubber Gaskets for Hub and Spigot Cast Iron Soil Pipe and Fittings

COMMERCIAL ITEM DESCRIPTION (CID)

CID A-A-238	(Rev B) Seat, Water Closet

FEDERAL SPECIFICATIONS (FS)

FS OO-D-431	(Rev E) Dishwashing Machines, Commercial (Rack, Stationary)
FS QQ-C-40	(Basic; Am 2; Notice 1) Calking: Lead Wool and Lead Pig
FS QQ-L-201	(Rev F; Am 2) Lead Sheet
FS TT-P-1536	(Rev A) Plumbing Fixture Setting Compound
FS WW-C-440	(Rev B; Am 2) Clamps, Hose, (Low-Pressure)
FS WW-P-541/GEN	(Rev E; Am 1) Plumbing Fixtures
FS WW-P-541/1	(Rev B; Am 1) Plumbing Fixtures (Water Closets)
FS WW-P-541/2	(Rev B; Am 1) Plumbing Fixtures (Urinals)
FS WW-P-541/3	(Rev B; Am 1) Plumbing Fixtures (Bathtubs)
FS WW-P-541/4	(Rev B; Am 1) Plumbing Fixtures (Lavatories)
FS WW-P-541/5	(Rev B; Am 1) Plumbing Fixtures (Sinks, Kitchen, Service, and Laundry Trays)
FS WW-P-541/6	(Rev B; Int Am 1) Plumbing Fixtures (Drinking Fountains)
FS WW-P-541/7	(Rev C; Am 1) Plumbing Fixtures (Shower Bath and Emergency Eye and Face Wash Outfits)
FS WW-P-541/9	(Rev B; Am 1) Plumbing Fixtures (Medical Facilities, Land Use)
FS WW-S-1913	(Rev A) Shower Head, Ball Joint (Integral Flow Control)

MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVE AND FITTINGS INDUSTRY (MSS)

MSS SP-73	(1991) Brazing Joints for Copper and Copper Alloy Pressure Fittings

MILITARY SPECIFICATIONS (MS)

MS MIL-G-15840	(Rev C; Am 3) Garbage Disposal Machines, Commercial and Household
MS MIL-R-19038	(Rev E) Rinser-Sanitizer, Can
MS MIL-T-27730	(Rev A) Tape, Antiseize, Polytetrafluoroethylene, With Dispenser

NATIONAL ASSOCIATION OF PLUMBING-HEATING-COOLING CONTRACTORS (NAPHCC)

NAPHCC-01	(1990; Supple 1991) National Standard Plumbing Code

NATIONAL SANITATION FOUNDATION (NSF)

NSF Std 14	(1965; Rev Dec 1988) Plastic Piping Components and Related Materials

PLUMBING AND DRAINAGE INSTITUTE (PDI)

PDI G-101	(1985) Testing and Rating Procedures for Grease Interceptors

UNDERWRITERS LABORATORIES (UL)

UL 430	(1986; Rev Jul 1992) Waste Disposers
UL 749	(1984; Rev Dec 1991) Household Dishwashers

1.2 GENERAL REQUIREMENTS

1.2.1 Standard Products

Materials and equipment shall be the standard products of a manufacturer regularly engaged in the manufacture of the products. Items of equipment shall essentially duplicate equipment that has been in satisfactory use at least 2 years prior to bid opening.

1.2.2 Verification of Dimensions

The Contractor shall become familiar with details of the work, verify dimensions in the field, and advise the Contracting Officer of any discrepancy before performing any work.

1.2.3 Code

All plumbing work shall be in accordance with NAPHCC-01, unless otherwise stated.

1.3 SUBMITTALS

The following shall be submitted in accordance with Section 01300 SUBMITTAL DESCRIPTIONS:

1.3.1 Tests, Flushing and Sterilization

Test reports in booklet from showing all field tests performed to adjust each component and all field tests performed to prove compliance with the specified performance criteria, completion and testing of the installed system. Each test report shall indicate the final position of controls.

Where materials or equipment are specified to comply with requirements of AGA, or ASME, proof of such compliance. The label or listing of the specified agency will be acceptable evidence. In lieu of the label or listing, a written certificate may be submitted from an approved, nationally recognized testing organization equipped to perform such services, stating that the items have been tested and conform to the requirements and testing methods of the specified agency. Where equipment if specified to conform to requirements of the ASME Boiler and Pressure Vessel Code, the design, fabrication, and installation shall conform to the code.

1.3.2 Bolts

Written certification that the bolts furnished comply with the requirements of this specification, provided by the bolt manufacturer. The certification shall include illustrations of product-required markings, the date of manufacture, and the number of each type of bolt to be furnished based on this certification.

1.4 ELECTRICAL WORK

Electrical work shall be as specified in Section 16415C ELECTRICAL WORK, INTERIOR-WIRING.

PART 2 PRODUCTS

2.1 MATERIALS

2.1.1 Pipe

Pipe fittings shall be compatible with the applicable pipe materials. Pipe threads (except dry seal) shall conform to ASME B1.20.1. Grooved pipe couplings and fittings shall be of the same manufacturer. Material or equipment containing lead shall not be used in any potable water system.

2.1.2 Tubless Pipe

Hubless cast-iron soil pipe shall not be installed under concrete floor slabs or in crawl spaces below kitchen floors.

2.1.3 Plastic Pipe

Plastic pipe shall not be installed under concrete floor slabs, or in air plenums. Plastic pipe shall not be installed in a pressure piping system in buildings greater than three stories including any basement levels. Plastic pipe, fittings, and solvent cement shall meet NSF Std 14 and be NSF listed for the service intended. Plastic pipe, fittings, and solvent cement used for potable hot and cold water service shall bear the NSF seal NSF-PW. Polypropylene pipe shall conform to dimensional requirements for Schedule 40, Iron Pipe Size.

2.1.4 Pipe Joint Materials

Joints and gaskets materials shall conform to the following:

a. Caulking Lead: FS QQ-C-40, Type I.

b. Coupling for Cast-Iron Pipe: ASTM A 74, AWWA C606.

c. Coupling for Steel Pipe: AWWA C606.

d. Couplings for Grooved Pipe: Ductile Iron ASTM A 536 (Grade 65-45-12).

e. Nonmetallic Flange Gaskets for Flanges: ASME B16.21.

f. Neoprene Gaskets for Hub and Cast-Iron Pipe and Fittings: CISPI STD HSN.

g. Metal Solder: ASTM B 32, 95-5, tin-antimony.

h. Silver Brazing Joints for Wrought and Cast Solder-Joint Fittings: MSS SP-73.

i. PTFE Tape, for use with Threaded Metal or Plastic Pipe: MS MIL-T-27730.

j. Rubber Gaskets for Cast-Iron Soil-Pipe and Fittings: ASTM C 564.

k. Rubber Gaskets for Grooved Pipe: ASTM D 2000, designation M2CA615A15B44F17Z, maximum temperature 230 degrees F.

l. Flexible Elastomeric Seals: ASTM D 3139 or ASTM D 3212.

m. Bolts and Nuts for Grooved Pipe Couplings: Heat-treated carbon steel, ASTM A 183.

n. Solvent Cement for Transition Joints between ABS and PVC Nonpressure Piping Components: ASTM D 3138.

o. Plastic Solvent Cement for ABS Plastic Pipe: ASTM D 2235.

p. Plastic Solvent Cement for PVC Plastic Pipe: ASTM D 2564 and ASTM D 2855.

q. Plastic Solvent Cement for CPVC Plastic Pipe: ASTM F 493.

2.1.5 Miscellaneous Materials

Miscellaneous materials shall conform to the following:

a. Copper, Sheet and Strip for Building Construction: ASTM B 370.

b. Lead, Sheet: FS QQ-L-201, Grade B.

c. Hose Clamps: FS WW-C-440.

d. Supports for Off-The-Floor Plumbing Fixtures: ASME A112.6.1M.

e. Plumbing Fixture Setting Compound: FS TT-P-1536, Type II.

2.2 VALVES

Valves shall be provided on supplies to equipment and fixtures.

2.3 FIXTURES

Fixtures shall be water conservation type, in accordance with the National Standard Plumbing Code. Fixtures for use by the physically handicapped shall be in accordance

with ANSI A117.1. Vitreous china, nonabsorbent, hard-burned, and vitrified throughout the body shall be provided. Porcelain enameled ware shall have specially selected, clear white, acid- resisting enamel coating evenly applied on surfaces. No fixture will be accepted that shows cracks, crazes, blisters, thin spots, or other flaws. Fixtures shall be equipped with appurtenances such as traps, faucets, stop valves, and drain fittings. Each fixture and piece of equipment requiring connections to the drainage system, except grease interceptors, shall be equipped with a trap. Brass expansion or toggle bolts capped with acorn nuts shall be provided for supports, and polished chromium-plated pipe, valves, and fittings shall be provided where exposed to view. Fixtures with the supply discharge below the rim shall be equipped with backflow preventers. Internal parts of flush valves, shower mixing valves, shower head face plates, pop-up stoppers of lavatory waste drains, and pop-up stoppers and overflow tees and shoes of bathtub waste drains may contain acetal resin, fluorocarbon, nylon, acrylonitrile-butadiene-styrene (ABS) or other plastic material, if the material has provided satisfactory service under actual commercial or industrial operating conditions for not less than 2 years. Plastic in contact with hot water shall be suitable for 180 degrees F water temperature. Plumbing fixtures shall be as indicated in Plumbing Fixture Schedule attached at the end of this section of the specifications.

2.4 BACKFLOW PREVENTERS

Backflow preventers with intermediate atmospheric vent shall be in accordance with ASSE 1012.

2.5 DRAINS

2.5.1 Floor and Shower Drains

Floor and shower drains shall conform to ASME A112.21.1M. Drains installed in connection with waterproofed floors or shower pans shall be equipped with bolted-type device to securely clamp flashing.

2.5.2 Area Drains

Drains shall conform to ASME A112.21.1M.

2.6 SHOWER PAN

Shower pan may be lead, copper, or nonmetallic material.

2.6.1 Sheet Lead

Sheet lead shall be 6-pound weight, except that 4-pound sheet lead may be used for each pan installed without joints or seams other than corner seams.

2.6.2 Sheet Copper

Sheet copper shall be 16-ounce weight.

2.6.3 Nonplasticized Chlorinated Polyethylene Shower Pan Material

Material shall be sheet form. The material shall be 0.040-inch minimum thickness of nonplasticized chlorinated polyethylene.

2.6.4 Nonplasticized Poly(Vinyl Chloride) (PVC) Shower Pan Material

Material shall consist of a plastic waterproofing membrane in sheet form. The material shall be 0.040-inch minimum thickness of nonplasticized PVC.

2.7 TRAPS

Unless otherwise specified herein, traps shall be copper-alloy adjustable tube type with slip joint inlet and swivel. Traps shall be without a cleanout. Tubes shall be 20-gauge or more copper alloy. Inlets shall have rubber washer and copper alloy nuts for slip joints above the discharge level. Swivel joints shall be below the discharge level and shall be of metal-to-metal or metal-to-plastic type as required for the application. Nuts shall have flats for wrench grip. Outlets shall have internal pipe thread, except that when required for the application, the outlets shall have sockets for solder-joint connections. The depth of the water seal shall be not less than 2 inches. The interior diameter shall be not more than 1/8 inch over or under the nominal size, and interior surfaces shall be reasonably smooth throughout. A copper alloy "P" trap assembly consisting of an adjustable "P" trap and treaded trap wall nipple with cast brass wall flange shall be provided for lavatories. The assembly shall be a standard manufactured unit and may have a rubber-gasketed swivel joint.

PART 3 EXECUTION

3.1 PLUMBING FIXTURE SCHEDULE

P-1 WATER CLOSET:

Siphon-jet, elongated bowl, top supply spud, FS WW-P-541/GEN and FS WW-P-541/1, (SPN SJEB201, floor mounted) (SPN SJEB225, wall mounted). Floor flange shall be copper alloy, cast iron, or plastic.

Gasket shall be wax type.

Seat - CID A-A-238, Type A, white plastic, elongated, open front.

Flush Valve - ASSE 1037, (SPN 1a3.5), large diaphragm type with non-hold-open feature, backcheck angle control stop, and vacuum breaker. Minimum upper chamber inside diameter of not less than 2-5/8 inches at the point where the diaphragm is sealed between the upper and lower chambers.

P-2 BATHTUB:

Straight front, recessed, 60 inch x 32 inch x 16 inch, FS WW-P-541/3, enameled cast iron, raised bottom.

Drain Assembly - Plug, cup strainer, overflow assembly, washers, couplings, pop-up lever, trip lever, stopper, fittings, etc. shall be brass, cast copper alloy, or wrought copper alloy. See paragraph FIXTURES for optional plastic accessories.

P-3 KITCHEN SINK:

FS WW-P-541/5, ledge back with holes for faucet and spout single bowl 24 x 21 stainless steel.

Faucet and Spout - Cast or wrought copper alloy. Aerator shall have internal threads.

Handle - Cast copper alloy, wrought copper alloy, or stainless steel. Single lever type.

Drain Assembly - Plug, cup strainer, crossbars, jam nuts, washers, couplings, stopper, etc. shall be copper alloy or stainless steel.

P-4 SHOWER:

FS WW-P-541/7.

Wall Mounted - (Part A, Type III). Shower head shall conform to FS WW-S-1913, Type I, nonadjustable spray, stainless steel or chromium plated brass with ball joint and tamperproof flow control device integral with shower head. The flow control device shall limit the flow to a maximum of 2.75 gpm. Handles shall be chrome-plated die cast zinc alloy. Control valves shall be copper alloy and have metal integral parts of copper alloy, nickel alloy, or stainless steel. Valves shall be separate hot and cold water type.

P-5 GARBAGE DISPOSAL MACHINES:

Garbage disposal machines shall be in accordance with MS MIL-G-15840.

P-6 DISHWASHING MACHINES:

Household dishwashing machines shall conform to UL 749 and ASSE 1006 and sized as indicated.

END OF SECTION

SECTION 15400C

PLUMBING, WATER HEATERS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI Z21.10.1	(1990; Z21.10.1a) Gas Water Heaters Volume I: Storage Water Heaters with Input Ratings of 75,000 Btu Per Hour or Less
ANSI Z21.10.3	(1990; Z21.10.3a) Gas Water Heaters Vol III; Storage, with Input Rating Above 75,000 Btu Per Hour, Circulating and Instantaneous Water Heaters
ANSI Z21.22	(1990; Z21.22a) Relief Valves and Automatic Gas Shutoff Devices for Hot Water Supply Systems

AMERICAN SOCIETY OF HEATING, REFRIGERATING AND AIR-CONDITIONING ENGINEERS (ASHRAE)

ASHRAE 90A	(1980; 90A-a) Energy Conservation in New Building Design

AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)

ASME-13	(1989; Addenda 1989, 1990, 1991) Boiler and Pressure Vessel Code; Section IV, Heating Boilers
ASME B40.1	(1991) Gauges - Pressure Indicating Dial Type - Elastic Element
ASME CSD-1	(1992) Controls and Safety Devices for Automatically Fired Boilers

AMERICAN SOCIETY OF SANITARY ENGINEERING (ASSE)

ASSE 1005	(1986) Water Heater Drain Valves - 3/4-Inch Iron Pipe Size

CODE OF FEDERAL REGULATIONS (CFR)

CFR 21 Part 175	Indirect Food Additives: Adhesives and Components of Coatings

MILITARY SPECIFICATIONS (MS)

MS MIL-H-12322	(Rev D) Heater, Water, Steam- Hot-Water Heated
MS MIL-T-12295	(Rev E; Am 2) Tanks, Hot Water Storage

NATIONAL ASSOCIATION OF PLUMBING-HEATING-COOLING CONTRACTORS (NAPHCC)

NAPHCC-01	(1990; Supple 1991) National Standard Plumbing Code

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 31	(1987) Installation of Oil Burning Equipment
NFPA 54	(1988) National Fuel Gas Code

SCIENTIFIC APPARATUS MAKERS ASSOCIATION (SAMA)

SAMA Z236.1	(1983) General Purpose Lab Use for Liquid-in-Glass Thermometers

UNDERWRITERS LABORATORIES (UL)

UL 174	(1989; Rev thru Jan 1991) Household Electric Storage-Tank Water Heaters
UL 732	(1988) Oil-Fired Water Heaters

1.2 GENERAL REQUIREMENTS

1.2.1 Standard Products

Materials and equipment shall be the standard products of a manufacturer regularly engaged in the manufacture of the products. Items of equipment shall essentially duplicate equipment that has been in satisfactory use at least 2 years prior to bid opening.

1.2.2 Verification of Dimensions

The Contractor shall become familiar with details of the work, verify dimensions in the field, and advise the Contracting Officer of any discrepancy before performing any work.

1.2.3 Code

All plumbing work shall be in accordance with NAPHCC-01, unless otherwise stated.

1.3 SUBMITTALS

The following shall be submitted in accordance with Section 01300 SUBMITTAL DESCRIPTIONS:

1.3.1 Tests, Flushing and Sterilization

Tests reports in booklet form showing all field tests performed to adjust each component and all field tests performed to prove compliance with the specified performance criteria, completion and testing of the installed system. Each test report shall indicate the final position of controls.

1.3.2 Materials and Equipment

Where materials or equipment are specified to comply with requirements of AGA, or ASME, proof of such compliance. The label or listing of the specified agency will be acceptable evidence. In lieu of the label or listing, a written certificate may be submitted from an approved, nationally recognized testing organization equipped to perform such services, stating that the items have been tested and conform to the requirements and testing methods of the specified agency. Where equipment if specified to conform to requirements of the ASME Boiler and Pressure Vessel Code, the design, fabrication, and installation shall conform to the code.

1.3.3 Bolts

Written certification that the bolts furnished comply with requirements of this specification, provided by the bolt manufacturer. The certification shall include illustrations of product-required markings, the date of manufacture, and the number of each type of bolt to be furnished based on this certification.

1.3.4 Plumbing System

Six copies of the operation manual outlining the step-by-step procedures required for system startup, operation and shutdown. The manual shall include the manufacturer's name, model number, service manual, parts list, and brief description of all equipment and their basic operating features. Six copies of the maintenance manual listing routine maintenance procedures, possible breakdowns and repairs. The manual shall include piping and equipment layout and simplified wiring and control diagrams of the system as installed.

1.4 ELECTRICAL WORK

Electrical work shall be as specified in Section 16415C ELECTRICAL WORK, INTERIOR-WIRING.

PART 2 PRODUCTS

2.1 MATERIALS

a. Gauges - Pressure and Vacuum Indicating Dial Type - Elastic Element: ASME B40.1.

b. Thermometers: SAMA Z236.1.

2.2 VALVES

Water Heater Drain Valves	ASSE 1005
Temperature and Pressure Relief Valves for Hot Water Supply Systems	ANSI Z21.22 and ASME-13
Temperature and Pressure Relief Valves for Automatically Fired Hot Water Boilers	ASME CSD-1 Safety Code No., Part CW, Article 5

2.3 WATER HEATER

Water heater types and capacities shall be as indicated.

2.3.1 Automatic Storage Type

The thermal efficiency and standby heat loss shall comply with the requirements of ASHRAE 90A. Heaters shall be complete with control system, temperature gauge, pressure gauge, and shall have ASME rated combination pressure and temperature relief valve.

2.3.2 Oil-Fired Type

Oil-fired type water heaters shall conform to UL 732.

2.3.2.1 Gas-Fired Type

Gas-fired water heaters shall conform to ANSI Z21.10.1 when input is 75,000 Btu per hour or less or ANSI Z21.10.3 for heaters with input greater than 75,000 Btu per hour.

2.3.2.3 Electric Type

Electric type water heaters shall conform to UL 174, with dual heating elements. Each element shall be 4.5 kW. The elements shall be wired so that only one element can operate at a time.

2.3.2.4 Indirect Heater Type

Heaters shall be in accordance with MS MIL-H-12322, Class 1 and shall be the assembled product of one manufacturer, be ASME stamped for 150 psi working pressure, and have the National Board (ASME) registration. The storage tank shall be as specified in paragraph HOT-WATER STORAGE TANKS. The coil shall be as specified in paragraph Phenolic Resin Coatings.

a. Hot-Water Energy Source: Hot-water energy source water heaters shall be ASME stamped for 150 psi working pressure, and shall have the National Board (ASME) registration.

b. Steam Energy Source: Steam energy source water heaters shall be ASME stamped for 150 psi working pressure, and shall have the National Board (ASME) registration.

2.3.3 Phenolic Resin Coatings

The phenolic resin coil coating system shall be a product specifically intended for use on steel, copper, copper alloy, and stainless steel water heating coils. All coating components shall be capable of withstanding dry heat temperatures up to 400 degrees F. All coating material shall meet the requirements of CFR 21 Part 175. The coating system shall consist of the following three components:

2.3.3.1 Wash Primer

The wash primer shall be composed of a combination of polyvinyl butyral and a heat hardening phenolic resin. The weight per gallon shall be between 7.0 lbs/gallon and 7.4 lbs./gallon.

2.3.3.2 Pigmented Base Coat

The pigmented baking phenolic base coat shall consist of heat hardening phenolic resins, suitable pigments of the earth type, and softening agents. It shall not contain drying oils or cellulose material. The weight per gallon shall be between 10.3 lbs/gallon and 10.7 lbs/gallon. The non-volatile solids content shall be between 60 percent and 64 percent by weight.

2.3.3.3 Clear Top Coat

The clear non-pigmented baking phenolic top coat shall have a weight per gallon of between 8.65 lbs/gallon and 8.95 lbs/gallon. The non-volatile solids content shall be between 48 percent and 52 percent by weight.

2.4 HOT-WATER STORAGE TANKS

Hot-water storage tanks shall be constructed by one manufacturer, ASME stamped for the working pressure, and shall have the National Board (ASME) registration. The standby heat loss shall comply with the requirements of ASHRAE 90A. Storage tank capacity shall be as shown. Hot-water storage tanks shall conform to MS MIL-T-12295. Each tank shall be equipped with a thermometer conforming to SAMA Z236.1, Type I, Class 3, Range C, style and form as required for the installation, and with 7-inch scale. Thermometer shall have a separable socket suitable for a 3/4-inch tapped opening.

PART 3 EXECUTION

3.1 DISSIMILAR PIPE MATERIALS

Connections to water heaters shall be made with dielectric unions or flanges. Connecting joints between plastic and metallic pipe shall be made with transition fitting for the specific purpose.

3.2 RELIEF VALVES

No other valves shall be installed between the relief valve and the water heater. The relief valve shall be installed where the valve actuator comes in contact with the hottest water in the heater. Whenever possible, the valve shall be installed directly in a tapping in the tank or heater. When heaters are not provided with a relief valve tapping, the valve shall be installed in the hot-water outlet piping. A discharge pipe the size of the valve outlet shall be connected to the valve outlet and terminated at a safe location. A vacuum relief valve shall be provided on the cold water supply line to the hot-water storage tank or water heater and mounted within 6 inches above the top of the tank or water heater.

3.3 INSTALLATION OF GAS- AND OIL-FIRED WATER HEATER

Installation shall conform to NFPA 54 for gas fired and NFPA 31 for oil fired.

3.4 PHENOLIC RESIN APPLICATION PROCESS

The phenolic resin coating shall be applied at either the coil or coating manufacturer's factory.

END OF SECTION

SECTION 15400F

PLUMBING, PRESSURE PIPING

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 36	(1991) Structural Steel
ASTM A 47	(1990) Ferritic Malleable Iron Castings
ASTM A 53	(1990b) Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless
ASTM A 183	(1983; R 1990) Carbon Steel Track Bolts and Nuts
ASTM A 536	(1984) Ductile Iron Castings
ASTM A 733	(1989) Welded and Seamless Carbon Steel and Austenitic Stainless Steel Pipe Nipples
ASTM B 32	(1991) Solder Metal
ASTM B 42	(1992) Seamless Copper Pipe, Standard Sizes
ASTM B 43	(1991) Seamless Red Brass Pipe, Standard Sizes
ASTM B 88	(1992) Seamless Copper Water Tube
ASTM B 370	(1988) Copper Sheet and Strip for Building Construction
ASTM B 641	(1992) Seamless and Welded Copper Distribution Tube (Type D)
ASTM D 1785	(1991) Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120

ASTM D 2000	(1990) Rubber Products in Automotive Applications
ASTM D 2241	(1989) Poly(Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series)
ASTM D 2447	(1989) Polyethylene (PE) Plastic Pipe, Schedules 40 and 80, Based on Outside Diameter
ASTM D 2464	(1991) Threaded Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80
ASTM D 2466	(1990a) Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40
ASTM D 2467	(1990) Socket-Type Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80
ASTM D 2564	(1991) Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Piping Systems
ASTM D 2662	(1989) Polybutylene (PB) Plastic Pipe (SIDR-PR) Based on Controlled Inside Diameter
ASTM D 2666	(1989) Polybutylene (PB) Plastic Tubing
ASTM D 2672	(1989) Joints for IPS PVC Pipe Using Solvent Cement
ASTM D 2683	(1990) Socket-Type Polyethylene Fittings for Outside Diameter-Controlled Polyethylene Pipe and Tubing
ASTM D 2737	(1989) Polyethylene (PE) Plastic Tubing
ASTM D 2822	(1991) Asphalt Roof Cement
ASTM D 2846	(1990a) Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Hot-and Cold-Water Distribution Systems
ASTM D 2855	(1990) Making Solvent-Cemented Joints with Poly(Vinyl Chloride) (PVC) Pipe and Fittings
ASTM D 2996	(1988) Filament-Wound "Fiberglass" (Glass-Fiber-Reinforced Thermosetting-Resin) Pipe

ASTM D 3000	(1989) Polybutylene (PB) Plastic Pipe (SDR-PR) Based on Outside Diameter
ASTM D 3035	(1991) Polyethylene (PE) Plastic Pipe (SDR-PR) Based on Controlled Outside Diameter
ASTM D 3139	(1989) Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals
ASTM D 3212	(1989) Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals
ASTM D 3261	(1990) Butt Heat Fusion Polyethylene (PE) Plastic Fittings for Polyethylene (PE) Plastic Pipe and Tubing
ASTM D 3309	(1989a) Polybutylene (PB) Plastic Hot-and Cold-Water Distribution Systems
ASTM F 437	(1989b) Threaded Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 80
ASTM F 438	(1990) Socket-Type Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 40
ASTM F 439	(1990) Socket-Type Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 80
ASTM F 441	(1989) Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe, Schedules 40 and 80
ASTM F 442	(1989) Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe (SDR-PR)
ASTM F 493	(1989) Solvent Cements for Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe and Fittings

AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)

ASME-17	(1989; Addenda 1989, 1990, 1991) Boiler and Pressure Vessel Code; Section IX, Welding and Brazing Qualifications
ASME A112.1.2	(1991) Air Gaps in Plumbing Systems
ASME A112.36.2M	(1991) Cleanouts

ASME B1.20.1	(1983) Pipe Threads, General Purpose (Inch)
ASME B16.3	(1985) Malleable Iron Threaded Fittings, Classes 150 and 300
ASME B16.15	(1985) Cast Bronze Threaded Fittings Classes 125 and 250
ASME B16.18	(1984) Cast Copper Alloy Solder Joint Pressure Fittings
ASME B16.21	(1978) Nonmetallic Flat Gaskets for Pipe Flanges
ASME B16.22	(1989) Wrought Copper and Copper Alloy Solder Joint Pressure Fittings
ASME B16.24	(1991) Bronze Pipe Flanges and Flanged Fittings, Class 150 and 300
ASME B16.39	(1986) Malleable Iron Threaded Pipe Unions Classes 150, 250, and 300
ASME B31.1	(1992) Power Piping

AMERICAN SOCIETY OF SANITARY ENGINEERING (ASSE)

ASSE 1001	(1988) Pipe Applied Atmospheric Type Vacuum Breakers
ASSE 1003	(1981) Water Pressure Reducing Valves for Domestic Water Supply Systems
ASSE 1011	(1981) Hose Connection Vacuum Breakers
ASSE 1012	(1978) Backflow Preventers with Intermediate Atmospheric Vent
ASSE 1013	(1988) Reduced Pressure Principle Backflow Preventers
ASSE 1018	(1986) Trap Seal Primer Valves - Water Supply Fed

AMERICAN WATER WORKS ASSOCIATION (AWWA)

AWWA-01	(1989) Standard Methods for the Examination of Water and Wastewater
AWWA B300	(1987) Hypochlorites

AWWA B301	(1987; B301a) Liquid Chlorine
AWWA C105	(1988) Polyethylene Encasement for Ductile-Iron Piping for Water and Other Liquids
AWWA C203	(1986) Coal-Tar Protective Coatings and Linings for Steel Water Pipelines - Enamel and Tape - Hot-Applied
AWWA C606	(1987) Grooved and Shouldered Joints
AWWA M20	(1973) Water Chlorination Principles and Practices

CAST IRON SOIL PIPE INSTITUTE (CISPI)

CISPI Std HSN	(1985) Neoprene Rubber Gaskets for Hub and Spigot Cast Iron Soil Pipe and Fittings

FEDERAL SPECIFICATIONS (FS)

FS QQ-L-201	(Rev F; Am 2) Lead Sheet
FS TT-S-00230	(Rev C) Sealing Compound: Elastomeric Type, Single Component (for Calking, Sealing, and Glazing in Buildings and Other Structures)
FS TT-S-001543	(Rev A) Sealing Compound: Silicone Rubber Base (for Calking, Sealing, and Glazing in Buildings and Other Structures)
FS WW-C-440	(Rev B; Am 2) Clamps, Hose, (Low-Pressure)
FS WW-U-516	(Rev B; Notice 1) Unions, Brass or Bronze, Threaded Pipe Connections, and Solder Joint Tube Connections
FS WW-V-35	(Rev C) Valve, Ball

FOUNDATION FOR CROSS-CONNECTION CONTROL AND HYDRAULIC RESEARCH (FCCHR)

FCCHR-01	(Jun 1988) Manual of Cross-Connection Control

MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVE AND FITTINGS INDUSTRY (MSS)

MSS SP-44	(1991) Steel Pipe Line Flanges
MSS SP-58	(1988) Pipe Hangers and Supports - Materials, Design and Manufacture
MSS SP-67	(1990) Butterfly Valves
MSS SP-69	(1991) Pipe Hangers and Supports - Selection and Application
MSS SP-70	(1990) Cast Iron Gate Valves, Flanged and Threaded Ends
MSS SP-71	(1990) Cast Iron Swing Check Valves, Flanges and Threaded Ends
MSS SP-72	(1992) Ball Valves with Flanged or Butt-welding Ends for General Service
MSS SP-73	(1991) Brazing Joints for Copper and Copper Alloy Pressure Fittings
MSS SP-78	(1987; R 1992) Cast Iron Plug Valves, Flanged and Threaded Ends
MSS SP-80	(1987) Bronze Gate, Globe, Angle and Check Valves
MSS SP-83	(1987) Steel Pipe Unions Socket-Welding and Threaded
MSS SP-84	(1990) Steel Valves - Socket Welding and Threaded Ends
MSS SP-85	(1985) Cast Iron Globe & Angle Valves Flanged and Threaded Ends

MILITARY SPECIFICATIONS (MS)

MS MIL-T-27730	(Rev A) Tape, Antiseize, Polytetrafluoroethylene, With Dispenser

NATIONAL ASSOCIATION OF PLUMBING-HEATING-COOLING CONTRACTORS (NAPHCC)

NAPHCC-01	(1990; Supple 1991) National Standard Plumbing Code

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 90A (1989) Installation of Air Conditioning and Ventilating Systems

NATIONAL SANITATION FOUNDATION (NSF)

NSF Std 14 (1965; Rev Dec 1988) Plastic Piping Components and Related Materials

PLUMBING AND DRAINAGE INSTITUTE (PDI)

PDI-WH 201 (1977) Water Hammer Arresters

1.2 GENERAL REQUIREMENTS

1.2.1 Standard Products

Materials and equipment shall be the standard products of a manufacturer regularly engaged in the manufacture of the products. Items of equipment shall essentially duplicate equipment that has been in satisfactory use at least 2 years prior to bid opening.

1.2.2 Verification of Dimensions

The Contractor shall become familiar with details of the work, verify dimensions in the field, and advise the Contracting Officer of any discrepancy before performing any work.

1.2.3 Code

All plumbing work shall be in accordance with NAPHCC-01, unless otherwise stated.

1.2.4 Welding

Piping shall be welded using procedures and welders qualified in accordance with ASME-17 and ASME B31.1. The Contracting Officer shall be furnished with a copy of qualified procedures and a list of names and identification symbols of qualified welders and welding operators. Welders or welding operators shall apply their assigned symbols near each weld they make as a permanent record.

1.3 SUBMITTALS

The following shall be submitted in accordance with Section 01300 SUBMITTAL DESCRIPTIONS:

1.3.1 Tests, Flushing and Sterilization

Test reports in booklet form showing all field tests performed to adjust each component and all field tests performed to prove compliance with the specified performance criteria, completion and testing of the installed system. Each test report shall indicate the final position of controls.

Where materials or equipment are specified to comply with requirements of AGA, or ASME, proof of such compliance. The label or listing of the specified agency will be acceptable evidence. In lieu of the label or listing, a written certificate may be submitted from an approved, nationally recognized testing organization equipped to perform such services, stating that the items have been tested and conform to the requirements and testing methods of the specified agency. Where equipment if specified to conform to requirements of the ASME Boiler and Pressure Vessel Code, the design, fabrication, and installation shall conform to the code.

PART 2 PRODUCTS

2.1 MATERIALS

2.1.1 Pipe

Pipe threads (except dry seal) shall conform to ASME B1.20.1. Grooved pipe couplings and fittings shall be of the same manufacturer. Material or equipment containing lead shall not be used in any potable water system. Pipe materials shall be in accordance with Table I and II.

2.1.2 Hubless Pipe

Hubless cast-iron soil pipe shall not be installed under concrete floor slabs or in crawl spaces below kitchen floors.

2.1.3 Plastic Pipe

Plastic pipe shall not be installed under concrete floor slabs, or in air plenums. Plastic pipe shall not be installed in a pressure piping system in buildings greater than three stories including any basement levels. Plastic pipe, fittings, and solvent cement shall meet NSF Std 14 and be NSF listed for the service intended. Plastic pipe, fittings, and solvent cement used for potable hot and cold water service shall bear the NSF seal "NSF-PW".

Polypropylene pipe shall conform to dimensional requirements for Schedule 40, Iron Pipe Size.

2.1.4 Pipe Joint Materials

Joints and gaskets materials shall conform to the following:

a. Coupling for Steel Pipe: AWWA C606.

b. Couplings for Grooved Pipe: Ductile Iron ASTM A 536 (Grade 65-45-12).

c. Nonmetallic Flange Gaskets for Flanges: ASME B16.21.

d. Neoprene Gaskets for Hub and Cast-Iron Pipe and Fittings: CISPI Std HSN.

e. Metal Solder: ASTM B 32, 95-5, tin-antimony.

f. Silver Brazing Joints for Wrought and Cast Solder-Joint Fittings: MSS SP-73.

g. PTFE Tape, for use with Threaded Metal or Plastic Pipe: MS MIL-T-27730.

h. Rubber Gaskets for Grooved Pipe: ASTM D 2000, designation M2CA615A15B44F17Z, maximum temperature 230 degrees F.

i. Flexible Elastomeric Seals: ASTM D 3139 or ASTM D 3212.

j. Bolts and Nuts for Grooved Pipe Couplings: Heat-treated carbon steel, ASTM A 183.

k. Plastic Solvent Cement for PVC Plastic Pipe: ASTM D 2564 and ASTM D 2855.

l. Plastic Solvent Cement for CPVC Plastic Pipe: ASTM F 493.

2.1.5 Miscellaneous Materials

Miscellaneous materials shall conform to the following:

a. Water Hammer Arrester: PDI-WH 201.

b. Copper, Sheet and Strip for Building Construction: ASTM B 370.

c. Lead, Sheet: FS QQ-L-201, Grade B.

d. Asphalt Roof Cement: ASTM D 2822.

e. Hose Clamps: FS WW-C-440.

f. Metallic Cleanouts: ASME A112.36.2M.

g. Coal-Tar Protective Coatings and Linings for Steel Water Pipelines: AWWA C203.

h. Hypochlorites: AWWA B300.

i. Liquid Chlorine: AWWA B301.

j. Polyethylene Encasement for Ductile-Iron Piping: AWWA C105.

2.2 PIPE HANGERS, INSERTS, AND SUPPORTS

Pipe hangers, inserts, and supports shall conform to MSS SP-58 and MSS SP-69.

2.3 VALVES

Valves shall be provided on supplies to equipment and fixtures. Valves shall be gate valves, unless otherwise specified or indicated. Valves 2-1/2 inches and smaller shall be bronze, with threaded bodies for pipe and solder-type connections for tubing. Valves 3 inches and larger shall have flanged iron bodies and bronze trim. Pressure ratings shall be based upon the application. Valves used for water service shall have the zinc content limited to no more than 6 percent for the stem, body, bonnet, wedge, or disk in contact with the fluid. Grooved end valves may be provided if the manufacturer certifies that the valves meet the performance requirements of applicable MSS standard.

Description	Standard
Butterfly Valves	MSS SP-67
Cast-Iron Gate Valves, Flanged and Threaded Ends	MSS SP-70
Cast-Iron Swing Check Valves, Flanged and Threaded Ends	MSS SP-71
Ball Valves with Flanged Butt-Welding Ends for General Service	MSS SP-72
Ball Valves	FS WW-V-35
Cast-Iron Plug Valves, Flanged and Threaded Ends	MSS SP-78

Bronze Gate, Globe, Angle, and Check Valves	MSS SP-80
Steel Valves-Socket Welding and Threaded Ends	MSS SP-84
Cast-Iron Globe and Angle Valves, Flanged and Threaded Ends	MSS SP-85
Water Pressure Reducing Valves	ASSE 1003
Trap Seal Primer Valves	ASSE 1018

2.3.1 Wall Faucets

Wall faucets with vacuum-breaker backflow preventer shall be brass with 3/4-inch male inlet threads, hexagon shoulder, 3/4-inch hose connection. Faucet handle shall be securely attached to stem.

2.4 BACKFLOW PREVENTERS

Reduced pressure principle assemblies, double check valve assemblies, atmospheric (nonpressure) type vacuum breakers, and pressure type vacuum breakers shall be tested, approved, and listed in accordance with FCCHR-01. Backflow preventers with intermediate atmospheric vent shall be in accordance with ASSE 1012. Reduced pressure principle backflow preventers shall be in accordance with ASSE 1013. Hose connection vacuum breakers shall be in accordance with ASSE 1011. Pipe applied atmospheric type vacuum breakers shall be in accordance with ASSE 1001. Air gaps in plumbing systems shall be in accordance with ASME A112.1.2.

PART 3 EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

All piping located in air plenums shall conform to NFPA 90A requirements. The plumbing system shall be installed complete with necessary fittings, valves, and accessories. Piping shall be extended 5 feet outside the building, unless otherwise indicated. A gate valve or ball valve and drain on the water service line shall be installed inside the building approximately 6 inches above the floor from point of entry. Piping shall be connected to the exterior service lines or capped or plugged, if the exterior service is not in place. Sewer and water pipes shall be laid in separate trenches, except when otherwise shown. All exterior underground utilities shall be at least 12 inches below the average local frost

depth or as indicated. If trenches are closed or the pipes are otherwise covered before being connected to the service lines, the location of the end of each plumbing utility shall be marked with a stake or other acceptable means. Valves shall be installed horizontal or above ground.

3.1.1 Water Pipe, Fittings, and Connections

3.1.1.1 Utilities

The piping shall be extended as shown. The piping system shall be arranged and installed to permit draining. The supply line to each item of equipment or fixture, except faucets, flush valves, or other control valves which are supplied with integral stops, shall be equipped with a shut-off valve to enable isolation of the item for repair and maintenance without interfering with operation of other equipment or fixtures. Supply piping to fixtures, faucets, hydrants, shower heads, and flush valves shall be anchored to prevent movement.

3.1.1.2 Cutting and Repairing

The work shall be carefully laid out in advance, and unnecessary cutting of construction shall be avoided. Damage to building, piping, wiring, or equipment as a result of cutting shall be repaired by mechanics skilled in the trade involved.

3.1.1.3 Protection to Fixtures, Materials, and Equipment

Pipe openings shall be closed with caps or plugs during installation. Equipment shall be tightly covered and protected against dirt, water, chemicals, and mechanical injury. Upon completion of the work, the materials, and equipment shall be thoroughly cleaned, adjusted, and operated. Safety guards shall be provided for exposed rotating equipment.

3.1.1.4 Mains, Branches, and Runouts

Piping shall be installed as indicated. Pipe shall be accurately cut and worked into place without springing or forcing. Care shall be taken not to weaken structural portions of the building. Aboveground piping shall run parallel with the lines of the building, unless otherwise indicated. Supply pipes, valves, and fittings will be kept a sufficient distance from other work and other services to permit not less than 1/2 inch between finished covering on the different services. Water lines shall not bear directly against building structural elements. No water pipe shall be buried in or under floors unless specifically indicated or approved. Changes in pipe sizes shall be made with reducing fittings. Use of bushings will not be permitted. Change in direction shall be made with fittings, except

that bending of pipe 4 inches and smaller will be permitted, provided a pipe bender is used and wide sweep bends are formed. The center-line radius of bends shall be not less than 6 diameters of the pipe. Bent pipe showing kinks, wrinkles, flattening, or other malformations will not be acceptable.

3.1.1.5 Pipe Drains

Pipe drains indicated shall consist of 3/4-inch hose bibb with renewable seat and gate valve or ball valve ahead of hose bibb. At other low points, 3/4-inch brass plugs or caps shall be provided. Disconnection of the supply piping at the fixture is an acceptable drain.

3.1.1.6 Expansion and Contraction of Piping

Allowance shall be made throughout for expansion and contraction of water pipe. Each hot-water and hot-water circulation riser shall have expansion loops where indicated and required. Risers shall be securely anchored as required or where indicated to force expansion to loops. Branch connections from risers shall be made with ample swing or offset to avoid undue strain on fittings or short pipe lengths. Horizontal runs of pipe over 50 feet in length shall be anchored about midway on the run to force expansion, evenly divided, toward the ends. Sufficient flexibility shall be provided on branch runouts from mains and risers to provide for expansion and contraction of piping. Flexibility shall be provided by installing one or more turns in the line so that piping will spring enough to allow for expansion without straining. If mechanical grooved pipe coupling systems are provided, the deviation from design requirements for expansion and contraction may be allowed pending approval of Contracting Officer.

3.1.1.7 Commercial-Type Water Hammer Arresters

Commercial-type water hammer arresters shall be provided on hot- and cold-water supplies and shall be located as generally indicated, with precise location and sizing to be in accordance with PDI-WH 201. Water hammer arresters, where concealed, shall be accessible by means of access doors or removable panels. Commercial-type water hammer arresters shall be in accordance with PDI-WH 201. Vertical capped pipe columns will not be permitted.

3.1.2 Joints

Installation of pipe and fittings shall be made in accordance with the manufacturer's recommendations. Mitering of joints for elbows and notching of straight runs of pipe for tees will not be permitted. Threaded joints shall have American Standard taper pipe threads conforming to ASME B1.20.1. Only male pipe threads shall be coated with graphite or with an approved graphite compound, or with an inert filler and oil, or shall have a polytetrafluoroethylene tape applied. Mechanical couplings may be used in conjunction with grooved pipe for aboveground, ferrous, and domestic water systems.

Mechanical couplings are permitted in accessible locations, including behind access plates. Flexible grooved joints will not be permitted, except as vibration isolators adjacent to mechanical equipment. Rigid grooved joints shall incorporate an angle bolt pad design which maintains metal-to metal contact with equal amount of pad offset of housings upon installation to ensure positive rigid clamping of the pipe. Designs which can only clamp on the bottom of the groove or which utilize gripping teeth or jaws, or which use misaligned housing bolt holes, or which require a torque wrench or torque specifications will not be permitted. Rigid grooved pipe couplings shall be for use with grooved end pipes, fittings, valves and strainers. Rigid couplings shall be designed for not less than 125 psi service and appropriate for static head plus the pumping head, and shall provide a water-tight joint. Grooved fittings and couplings, and grooving tools shall be provided from the same manufacturer. Segmentally welded elbows shall not be used. Grooves shall be prepared in accordance with the coupling manufacturer's latest published standards. Grooving shall be performed by qualified grooving operators having demonstrated proper grooving procedures in accordance with the tool manufacturer's recommendations. The Contracting Officer shall be notified 24 hours in advance of test to demonstrate operator's capability, and the test shall be performed at the work site, if practical, or at an agreed upon site. The operator shall demonstrate the ability to properly adjust the grooving tool, groove the pipe, and to verify the groove dimensions in accordance with the coupling manufacturer's specifications. Unions and flanges and mechanical couplings shall not be concealed in walls, ceilings, or partitions. A dielectric union or flange shall be installed at the junction of ferrous to copper on pressure piping systems. Unions shall be used on pipe sizes 2-1/2 inches and smaller; flanges shall be used on pipe sizes 3 inches and larger.

3.1.2.1 Copper Tube

Joints for copper tubing shall be made with soldered or brazed fittings. Solder shall consist of 95 percent tin and 5 percent antimony. Tubes shall be cut square and reamed to remove burrs. Outside surface of the tube where engaged in the fitting, and inside surface of the fitting in contact with the tube, shall be cleaned with an abrasive material before soldering. Care shall be taken to prevent annealing of tube and fittings when making connections. Solder joints shall be made with flux and wire form or paste-type solder. The flux for solder shall be mildly corrosive liquid or petroleum-based paste containing chlorides of zinc and ammonia. Core solder shall not be used. Excess solder shall be wiped from joint before solder hardens. Joints in copper tube 2-1/2 inches and larger shall be made with heat applied uniformly around the entire circumference of the tube and fittings by a multiflame torch. Excess solder flux on the inside surface of the joint shall be avoided. Copper tube joints under floor slabs shall be brazed.

3.1.2.2 Copper Tube Extracted Joint

An extracted mechanical joint may be made in copper tube. Joint shall be produced with an appropriate tool by drilling a pilot hole and drawing out the tube surface to form a collar having a minimum height of three times the thickness of the tube wall. To prevent the branch tube from being inserted beyond the depth of the extracted joint, dimpled depth stops shall be provided. Also branch tube shall be notched for proper penetration into fitting to ensure a free flow joint. Extracted joints shall be brazed in accordance with NAPHCC-01 using B-Cup series filler metal in accordance with MSS SP-73. Soldered joints will not be permitted.

3.1.2.3 Plastic Pipe

ABS pipe shall have joints made with solvent cement. PVC and CPVC pipe shall have joints made with solvent cement elastomeric, threading (threading of schedule 80 pipe is allowed only where required for disconnection and inspection; threading of schedule 40 pipe is not allowed), or mated flanged.

PB pipe shall have joints made with copper or brass fittings of the compression or mechanical type for 3/4 inch and one inch sizes, and the heat type socket-fusion fittings for 1 inch, 1-1/4 inch, 1-1/2 inch, and 2 inch sizes.

3.1.3 Dissimilar Pipe Materials

Connections between ferrous and copper pipe shall be made with dielectric unions or flanges. Connecting joints between plastic and metallic pipe shall be made with transition fitting for the specific purpose.

3.1.4 Pipe Sleeves and Flashing

Pipe sleeves shall be furnished and set in their proper and permanent location.

3.1.4.1 Sleeve Requirements

Pipes passing through concrete or masonry shall be provided with pipe sleeves fitted into place at the time of construction. Sleeves shall not be required for cast-iron soil pipe passing through concrete slab on grade, except where penetrating a membrane waterproof floor. A modular mechanical type sealing assembly may be installed in lieu of a waterproofing clamping flange and caulking and sealing of annular space between pipe and sleeve. The seals shall consist of interlocking synthetic rubber links shaped to continuously fill the annular space between the pipe and sleeve with corrosion-protected carbon steel bolts, nuts, and pressure plates. The links shall be loosely assembled with bolts to form a continuous rubber belt around the pipe with a pressure plate under each bolt head and each nut. After the seal assembly is properly positioned in the sleeve,

tightening of the bolt shall cause the rubber sealing elements to expand and provide a watertight seal between the pipe and the sleeve. Each seal assembly shall be sized as recommended by the manufacturer to fit the pipe and sleeve involved. Sleeves shall not be installed in structural members, except where indicated or approved. Rectangular and square openings shall be as detailed. Each sleeve shall extend through its respective floor, or roof, and shall be cut flush with each surface, except for special circumstances. Pipe sleeves passing through floors in wet areas such as mechanical equipment rooms, lavatories, kitchens, and other plumbing fixture areas shall extend a minimum of 4 inches above the finished floor. Unless otherwise indicated, sleeves shall be of a size to provide a minimum of 1/4- inch clearance all-around between bare pipe and inside of sleeve or between jacket over insulation and sleeves. Sleeves in bearing walls shall be steel pipe or cast-iron pipe. Sleeves for membrane waterproof floors shall be steel pipe, cast-iron pipe, or plastic pipe. Membrane clamping devices shall be provided on pipe sleeves for waterproof floors. Sleeves in nonbearing walls or ceilings may be steel pipe, cast-iron pipe, galvanized sheet metal with lock-type longitudinal seam, or moisture-resistant fiber or plastic. Plastic sleeves shall not be used in nonbearing fire walls, roofs, or floor/ceilings. Except as otherwise specified, the annular space between pipe and sleeve, or between jacket over insulation and sleeve, shall be sealed as indicated and with sealants conforming to FS TT-S-00230 or FS TT-S-001543 and with a primer, backstop material and surface preparation as specified in Section 07920A CAULKING AND SEALANTS. Pipes passing through sleeves in concrete floors over crawl spaces shall be sealed as specified above. The annular space between pipe and sleeve or between jacket over insulation and sleeve shall not be sealed for interior walls which are not designated as fire rated.

3.1.4.2 Flashing Requirements

Pipes passing through roof or floor waterproofing membrane shall be installed through a 4-pound lead flashing or a 16-ounce copper flashing, each within an integral skirt or flange. Flashing shall be suitably formed, and the skirt or flange shall extend not less than 8 inches from the pipe and shall be set over the roof or floor membrane in a solid coating of bituminous cement. The flashing shall extend up the pipe a minimum of 10 inches. Pipes passing through pitched roofs shall be flashed, using lead or copper flashing, with an adjustable integral flange of adequate size to extend not less than 8 inches from the pipe in all directions and lapped into the roofing to provide a watertight seal. The annular space between the flashing and the bare pipe or between the flashing and the metal-jacket-covered insulation shall be sealed as indicated. Pipes, up to and including 10 inches in diameter, passing through roof or floor waterproofing membrane may be installed through a cast-iron sleeve with caulking recess, anchor lugs, flashing-clamp device, and pressure ring with brass bolts. Flashing shield shall be fitted into the sleeve clamping device. Pipes passing through wall waterproofing membrane shall be sleeved as described above. In addition, a waterproofing clamping flange shall be installed.

3.1.5 Supports

Pipe hangers, inserts and supports installation shall conform to MSS SP-58 and MSS SP-69, except as modified herein.

a. Types 5, 12, and 26 shall not be used.

b. Type 3 shall not be used on insulated pipe.

c. Horizontal pipe supports shall be spaced as specified in MSS SP-69 and a support shall be installed not over one foot from the pipe fitting joint at each change in direction of the piping. Pipe supports shall be spaced not over 5 feet apart at valves. Use 120 degrees F for PVC pipe and 180 degrees F for CPVC as operating temperatures in determining hanger spacing for PVC or CPVC pipe.

3.2 TESTS, FLUSHING, AND STERILIZATION

3.2.1 Plumbing System

The plumbing system shall be tested in accordance with NAPHCC-01.

3.2.2 Defective Work

If inspection or test shows defects, such defective work or material shall be replaced or repaired as necessary and inspection and tests shall be repeated. Repairs to piping shall be made with new materials. No caulking of screwed joints or holes will be acceptable.

3.2.3 Sterilization

After pressure tests have been made, the entire potable water distribution system shall be sterilized. System shall be thoroughly flushed with water of sufficient velocity until all entrained dirt and other foreign material have been removed, before introducing chlorinating material. The chlorinating material shall be hypochlorites or liquid chlorine. Water chlorination procedure shall be in accordance with AWWA M20. The chlorinating material shall be fed into the water piping system at a constant rate at a concentration of at least 50 parts per million (ppm). A properly adjusted hypochlorite solution injected into the main with a hypochlorinator, or liquid chlorine injected into the main through a solution-feed chlorinator and booster pump, shall be used. The chlorine residual shall be checked at intervals to ensure that the proper level is maintained. Chlorine application shall continue until the entire main is filled. The water shall remain in the system for a minimum of 24 hours. Each valve in the system being sterilized shall be opened and closed several times during the contact period to ensure its proper disinfection. Following the 24-hour period, no less than 25 ppm chlorine residual shall remain in the system. Water tanks shall be disinfected by the addition of chlorine directly to the filling water.

Following a 6-hour period, no less than 50 ppm chlorine residual shall remain in the tank. The system including the tanks shall then be flushed with clean water until the residual chlorine is reduced to less than one part per million. During the flushing period each valve and faucet shall be opened and closed several times. From several points in the system the Contracting Officer will take samples of water in properly sterilized containers for bacterial examination. The samples of water shall be tested for total coliform organisms (coliform bacteria, fecal coliform, streptococcal, and other bacteria) in accordance with AWWA-01. The testing method used shall be either the multiple - tube fermentation technique or the membrane - filter technique. The sterilizing shall be repeated until tests indicate the absence of coliform organisms (zero mean coliform density per 100 milliliters) in the samples for at least 2 full days. The system will not be accepted until satisfactory bacteriological results have been obtained.

TABLE I

PIPE AND FITTING MATERIALS FOR PRESSURE PIPING SYSTEMS SERVICE

Item No.	Pipe and Fitting Materials	A	B	C
1	Malleable-iron threaded fittings, galvanized, ASME B16.3 for use with Item 3	X	X	X
2	Grooved pipe couplings, ASTM A 36 and ASTM A 47	X	X	X
3	Steel pipe:			
	a. Seamless, galvanized, ASTM A 53, Type S, Grade B	X	X	X
	b. Seamless, black, ASTM A 53, Type S, Grade B			
4	Seamless red brass pipe, ASTM B 43	X	X	X

Item No.	Pipe and Fitting Materials	A	B	C
5	Bronze flanged fittings, ASME B16.24 for use with Items 4 and 6	X	X	X
6	Seamless copper pipe, ASTM B 42	X	X	X
7	Seamless copper water tube, ASTM B 88	X*	X*	X***
8	Seamless and welded copper distribution tube (Type D) ASTM B 641	X	X	X****
9	Cast bronze threaded fittings, ASME B16.15 for use with Items 4 and 6	X	X	X
10	Wrought copper and bronze solder-joint pressure fittings, ASME B16.22 for use with Items 7 and 8	X	X	X
11	Cast copper alloy solder-joint pressure fittings, ASME B16.18 for use with Items 7 and 8	X	X	X
12	Polyethylene (PE) plastic pipe, Schedules 40 and 80, based on outside diameter ASTM D 2447	X		
13	Polyethylene (PE) plastic pipe (SDR-PR), Based on controlled outside diameter, ASTM D 3035	X		
14	Butt fusion polyethylene (PE) plastic pipe fittings, ASTM D 3261 for use with Items 12, 13, and 16	X		

Item No.	Pipe and Fitting Materials	A	B	C
15	Socket-type polyethylene fittings for outside diameter-controlled polyethylene pipe, ASTM D 2683 for use with Item 13	X		
16	Polyethylene (PE) plastic tubing, ASTM D 2737	X		
17	Polybutylene (PB) plastic hot and cold water distribution systems, ASTM D 3309	X	X	
18	Polybutylene (PB) plastic pipe (SDR-PR), ASTM D 2662	X	X	
19	Polybutylene (PB) plastic pipe (SDR-PR) based on outside diameter, ASTM D 3000	X	X	
20	Polybutylene (PB) plastic tubing, ASTM D 2666	X		
21	Chlorinated polyvinyl chloride (CPVC) plastic hot and cold water distribution system, ASTM D 2846	X	X	
22	Chlorinated polyvinyl chloride (CPVC) plastic pipe, Schedule 40 and 80, ASTM F 441	X	X	
23	Chlorinated polyvinyl chloride (CPVC) plastic pipe (SDR-PR) ASTM F 442	X	X	
24	Threaded chlorinated polyvinyl chloride (CPVC) plastic pipe fittings, Schedule 80, ASTM F 437 for use with Items 21, 22, and 23	X	X	

Item No.	Pipe and Fitting Materials	A	B	C
25	Socket-type chlorinated polyvinyl chloride (CPVC) plastic pipe fittings, Schedule 40, ASTM F 438 for use with Items 21, 22, and 23	X	X	
26	Socket-type chlorinated polyvinyl chloride (CPVC) plastic pipe fittings Schedule 80, ASTM F 439 for use with Items 21, 22, and 23	X	X	
27	Polyvinyl chloride (PVC) plastic pipe, Schedules 40, 80, and 120, ASTM D 1785	X		
28	Polyvinyl chloride (PVC) pressure-rated pipe (SDR Series), ASTM D 2241	X		
29	Polyvinyl chloride (PVC) plastic pipe fittings, Schedule 40, ASTM D 2466	X		
30	Socket-type polyvinyl chloride (PVC) plastic pipe fittings, Schedule 80, ASTM D 2467	X		
31	Threaded polyvinyl chloride (PVC) plastic pipe fittings, Schedule 80, ASTM D 2464	X		
32	Bell-end polyvinyl chloride (PVC) pipe, ASTM D 2672	X		
33	Filament-wound reinforced thermosetting resin (RTRP) pipe, ASTM D 2996	X	X	
34	Steel pipeline flanges, MSS SP-44	X	X	

Item No.	Pipe and Fitting Materials	A	B	C
35	Unions: brass or bronze, FS WW-U-516	X	X	
36	Carbon steel pipe unions, socket-welding and threaded, MSS SP-83	X	X	
37	Malleable-iron threaded pipe unions ASME B16.39	X	X	
38	Nipples, pipe threaded ASTM A 733	X	X	

A - Cold Water Aboveground
B - Hot Water 180 F Maximum Aboveground
C - Cold Water Service Belowground Indicated types are minimum wall thicknesses.
* - Type M - Hard
** - Type L - Hard
*** - Type K - Hard temper with brazed joints only or type K-soft temper without joints in or under floors
**** - In or under slab floors only brazed joints

END OF SECTION

SECTION 15566

DUCTWORK FOR WARM AIR HEATING SYSTEMS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AIR DIFFUSION COUNCIL (ADC)

ADC 1062:GRD	(1984) Test Codes for Grilles, Registers, and Diffusers

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM D 1751	(1983; R 1991) Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types)
ASTM D 1752	(1984) Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction

MILITARY SPECIFICATIONS (MS)

MS DOD-P-21035	(Rev A) Paint, High Zinc Dust Content, Galvanizing Repair (Metric)

SHEET METAL & AIR CONDITIONING CONTRACTORS' NATIONAL ASSOCIATION (SMACNA)

SMACNA-06	(1985) HVAC Duct Construction Standards - Metal and Flexible
SMACNA-10	(1985) HVAC Air Duct Leakage Test Manual

UNDERWRITERS LABORATORIES (UL)

UL-01	(1992) Building Materials Directory

1.2 GENERAL REQUIREMENTS

1.2.1 Verification of Dimensions

The Contractor shall become familiar with all details of the work and working conditions, verify all dimensions in the field and shall advise the Contracting Officer of any discrepancy before performing any work.

1.3 DELIVERY AND STORAGE

Equipment delivered and placed in storage shall be stored with protection from the weather, humidity and temperature variations, dirt and dust, or other contaminants.

PART 2 PRODUCTS

2.1 DUCTWORK COMPONENTS

2.1.1 Metal Ductwork

All aspects of metal ductwork construction, including all fittings and components, shall comply with SMACNA-06 unless otherwise specified. Elbows shall be radius type with a centerline radius of 1-1/2 times the width or diameter of the duct where space permits. Otherwise, elbows having a minimum radius equal to the width or diameter of the duct or square elbows with factory fabricated turning vanes may be used. Static pressure Class 1/2, 1, and 2 inch w.g. ductwork shall meet the requirements of Seal Class C. Class 3 through 10 inch shall meet the requirements of Seal Class A. Sealants shall conform to fire hazard classifications. Pressure sensitive tape shall not be used as a sealant. Spiral lock seam duct, and flat oval shall be made with duct sealant and locked with not less than 3 equally spaced drive screws or other approved methods indicated in SMACNA-06. The sealant shall be applied to the exposed male part of the fitting collar so that the sealer will be on the inside of the joint and fully protected by the metal of the duct fitting. One brush coat of the sealant shall be applied over the outside of the joint to at least 2-inch band width covering all screw heads and joint gap. Dents in the male portion of the slip fitting collar will not be acceptable.

2.1.1.1 Transitions

Diverging air flow transitions shall be made with each side pitched out a maximum of 15 degrees, for an included angle of 30 degrees. Transitions for covering air flow shall be made with each side pitched in a maximum of 30 degrees, for an included angle of 60 degrees, or shall be as indicated. Factory-fabricated reducing fittings for systems using round duct sections when formed to the shape of the ASME short flow nozzle, need not comply with the maximum angles specified.

2.1.1.2 Flexible Duct Runouts

Flexible duct runouts shall be used only where indicated. Runouts shall not exceed 10 feet in length, shall be preinsulated, factory fabricated, and shall comply with NFPA 90A and UL 181. Either field or factory applied vapor barrier shall be provided. Where coil induction or high velocity units are supplied with vertical air inlets, a streamlined and vaned and mitered elbow transition piece shall be provided for connection to the flexible duct or hose. The last elbow to these units, other than the vertical air inlet type, shall be a die-stamped elbow and not a flexible connector. Insulated flexible connectors may be used as runouts. The insulated material and vapor barrier shall be as specified on the design drawings. The insulation material surface shall not be exposed to the air stream.

2.1.1.3 Flexible Duct Connectors

A flexible duct connector approximately 6 inches in width shall be provided where sheet metal connections are made to fans or where ducts of dissimilar metals are connected. For round/oval ducts, the flexible material shall be secured by stainless steel or zinc-coated, iron clinch-type draw bands. For rectangular ducts, the flexible material locked to metal collars shall be installed using normal duct construction methods. The composite connector system shall comply with UL 214 and be classified as "flame-retarded fabrics" in UL-01.

2.1.2 Ductwork Accessories

2.1.2.1 Air Deflectors and Branch Connections

Air deflectors shall be provided at all duct mounted supply outlets, at all takeoff or extension collars to supply outlets, at all duct branch takeoff connections, and at all 90 degree elbows, as well as at all locations as indicated on the drawings or shown in the Sheet Metal and Air Contractors National Association Manuals. All air deflectors, except those installed in 90 degree elbows, shall be provided with an approved means of adjustment. Adjustment shall be made from easily accessible means inside the duct or from an adjustment with sturdy lock on the face of the duct. When installed on ducts to be thermally insulated, external with the adjustment device, to provide clearance between the duct surface and the adjustment device not less than the thickness of the thermal insulation. Air deflectors shall be factory-fabricated units consisting of curved turning vanes or louver blades designed to provide uniform air distribution and change of direction with minimum turbulence or pressure loss. Air deflectors shall be factory or field assembled. Blade air deflectors, also called blade air extractors, shall be approved factory fabricated units consisting of equalizing grid and adjustable blade and lock. Adjustment shall be easily made from the face of the diffuser or by position adjustment and lock external to the duct. Stand-off brackets shall be provided on insulated ducts and

are described herein before. Fixed air deflectors, also called turning vanes, shall be provided in all 90 degree elbows. Turning vanes shall be designed as shown in the Sheet Metal and Air Condition Contractors National Association Manuals.

2.1.3 Duct Sleeves, Framed Prepared Openings, Closure Collars

2.1.3.1 Duct Sleeves

Duct sleeves shall be provided for all round ducts 15 inches in diameter or less passing through floors, walls, ceilings, or roof, and insulated during construction of the floor, wall, ceiling, or roof. Round ducts larger than 15 inches in diameter and all square, rectangular, and oval ducts passing through floors, walls, ceilings, or roof shall be installed through framed prepared openings. The Contractor shall be responsible for the proper size and location of sleeves and prepared openings. Sleeves and framed openings are also required where grilles, registers, and diffusers are installed at the openings. Framed prepared openings shall be fabricated from 20-gauge galvanized steel, unless otherwise indicated. Where sleeves are installed in bearing walls or partitions, black steel pipe, ASTM A 53, Schedule 20 shall be used. Sleeve shall provide 1-inch clearance between the duct and the sleeve or 1-inch clearance between the insulation and the sleeve for insulated ducts.

2.1.3.2 Framed Prepared Opening

Openings shall have 1-inch clearance between the duct and the opening or 1-inch clearance between the insulation and the opening for insulated ducts.

2.1.3.3 Closure Collars

Collars shall be fabricated of galvanized sheet metal not less than 4 inches wide, unless otherwise indicated, and shall be installed on exposed ducts on each side of walls or floors where sleeves or prepared openings are provided. Collars shall be installed tight against surfaces. Collars shall fit snugly around the duct or insulation. Sharp edges of the collar around insulated duct shall be ground smooth to preclude tearing or puncturing the insulation covering or vapor barrier. Collars for round ducts 15 inches in diameter or less shall be fabricated from 20-gauge galvanized steel. Collars for round duct larger than 15 inches and all square, and rectangular ducts shall be fabricated from 18-gauge galvanized steel. Collars shall be installed with fasteners on maximum 6-inch centers, except that not less than 4 fasteners shall be used.

2.1.4 Diffusers, Registers, and Grilles

Units shall be factory-fabricated of steel, corrosion-resistant steel, or aluminum and shall distribute the specified quantity of air evenly over space intended without causing noticeable drafts, air movement faster than 50 fpm in occupied zone, or dead spots

anywhere in the conditioned area. Outlets for diffusion, spread, throw, and noise level shall be as required for specified performance. Performance shall be certified in accordance with ADC 1062:GRD. Inlets and outlets shall be sound rated and certified in accordance with ADC 1062:GRD. Sound power level shall be as indicated. Diffusers and registers shall be provided with volume damper with accessible operator, unless otherwise indicated; or if standard with the manufacturer, an automatically controlled device will be acceptable. Volume dampers shall be opposed blade type for all diffusers and registers, except linear slot diffusers. Linear slot diffusers shall be provided with round or elliptical balancing dampers. Where the inlet and outlet openings are located less than 7 feet above the floor, they shall be protected by a grille or screen in accordance with NFPA 90A.

2.1.4.1 Registers and Grilles

Units shall be four-way directional-control type, except that return and exhaust registers may be fixed horizontal or vertical louver type similar in appearance to the supply register face. Registers shall be provided with sponge-rubber gasket between flanges and wall or ceiling. Wall supply registers shall be installed at least 6 inches below the ceiling unless otherwise indicated. Return and exhaust registers shall be located 6 inches above the floor unless otherwise indicated. Four-way directional control may be achieved by a grille face which can be rotated in 4 positions or by adjustment of horizontal and vertical vanes. Grilles shall be as specified for registers, without volume control damper.

PART 3 EXECUTION

3.1 DUCTWORK LEAK TEST

Ductwork leak test shall be performed for the air distribution system, including fans, coils, filters, etc. Ductwork leak test shall be completed with satisfactory results prior to applying insulation to ductwork exterior.

3.2 CLEANING

Ducts, plenums, and casings shall be thoroughly cleaned of all debris and blown free of all small particles of rubbish and dust before installing outlet faces. Equipment shall be wiped clean, with all traces of oil, dust, dirt, or paint spots removed.

END OF SECTION

SECTION 16415B

ELECTRICAL WORK, INTERIOR - LAMPS AND LIGHTING

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI C82.1	(1985; C82.1a; C82.1b; C82.1c) Ballasts for Fluorescent Lamps
ANSI C82.4	(1985; C82.4a) Ballasts for High-Intensity-Discharge and Low-Pressure Sodium Lamps (Multiple-Supply Type)

CODE OF FEDERAL REGULATIONS (CFR)

CFR 47 Part 18	Industrial, Scientific and Medical Equipment

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE C62.41	(1991) Surge Voltages in Low-Voltage AC Power Circuits

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA LE 4	(1987) Recessed Luminaires, Ceiling Compatibility

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	(1993) National Electrical Code
NFPA 101	(1991) Safety to Life from Fire in Buildings and Structures

UNDERWRITERS LABORATORIES (UL)

UL-03	(1992) Electrical Construction Materials Directory
UL 542	(1985; Rev thru Apr 1991) Lampholders, Starters, and Starter Holders for Fluorescent Lamps

UL 924	(1990; Rev Dec 1991) Emergency Lighting and Power Equipment
UL 935	(1984; Rev thru Dec 1991) Fluorescent-Lamp Ballasts
UL 1029	(1986; Rev thru Nov 1991) High-Intensity-Discharge Lamp Ballasts
UL 1570	(1988; Rev thru Jun 1992) Fluorescent Lighting Fixtures
UL 1571	(1991; Rev Jan 1992) Incandescent Lighting Fixtures
UL 1572	(1991; Rev Jan 1992) High Intensity Discharge Lighting Fixtures

1.2 GENERAL

1.2.1 Rules

The installation shall conform to the requirements of NFPA 70 and NFPA 101, unless more stringent requirements are indicated herein or shown.

1.2.2 Coordination

The drawings indicate the extent and the general location and arrangement of equipment, conduit, and wiring. The Contractor shall become familiar with all details of the work and verify all dimensions in the field. Lighting fixtures, outlets, and other equipment and materials shall be located to avoid interference with mechanical or structural features; otherwise, lighting fixtures shall be symmetrically located according to the room arrangement when uniform illumination is required, or asymmetrically located to suit conditions fixed by design and shown. Lighting fixtures shall not be supported from sheet metal roof decks. If any conflicts occur necessitating departures from the drawings, details of and reasons for departures shall be submitted and approved prior to implementing any change.

1.2.3 Standard Products

Material and equipment shall be a standard product of a manufacturer regularly engaged in the manufacture of the product and shall essentially duplicate items that have been in satisfactory use for at least 2 years prior to bid opening.

1.2.4 As Built Drawings

Following the project completion or turnover, within 30 days the Contractor shall furnish sets of as built drawings to the Contracting Officer.

1.3 SUBMITTALS

The following shall be submitted in accordance with Section 01300 SUBMITTAL DESCRIPTIONS:

1.3.1 Materials and Equipment

The label or listing of the Underwriters Laboratories, Inc., shall be accepted as evidence that the materials or equipment conform to the applicable standards of that agency. In lieu of this label or listing, a statement from a nationally recognized, adequately equipped testing agency indicating that the items have been tested in accordance with required procedures and that the materials and equipment comply with all contract requirements will be accepted. However, materials and equipment installed in hazardous locations must bear the UL label unless the data submitted from other testing agency is specifically approved in writing by the Contracting Officer.

1.4 WORKMANSHIP

Materials and equipment shall be installed in accordance with recommendations of the manufacturer and as shown.

PART 2 PRODUCTS

2.1 GENERAL REQUIREMENTS

Fixtures, accessories and components, including ballasts, lampholders, lamps, starters and starter holders, shall conform to industry standards specified below.

2.1.1 Fixture, Auxiliary or Emergency

UL 924.

2.1.2 Incandescent Fixture

NEMA LE 4 for ceiling compatibility of recessed fixtures and UL 1571.

2.1.3 Fluorescent

a. Fixture: NEMA LE 4 for ceiling compatibility of recessed fixtures and UL 1570. Plainly mark all fixtures for proper lamp and ballast type to include lamp diameter, wattage, color and start type. Markings shall be readily visible to service personnel, but not visible from normal viewing angles.

b. Ballasts:

(1) Magnetic Ballast, Energy-Saving, High Power Factor, Class P, Automatic-Resetting Type, approved for the application by the Certified Ballast Manufacturers: ANSI C82.1 and UL 935. Two-lamp ballasts shall be used for each pair of lamps within a fixture or within continuous mounted fixtures. Single-lamp ballasts shall be used for individually mounted single-lamp fixtures and where an odd single-lamp fixture occurs at the end of a continuous group. Magnetic fluorescent lamp ballasts shall have a Ballast Efficacy Factor (BEF) not less than shown in the following Table:

MAGNETIC FLUORESCENT BALLAST EFFICACY FACTORS*

Design starting temperature above 40 degrees F, with 60 Hz input frequency

NUMBER OF LAMPS	LAMP TYPE	NOMINAL OPERATIONAL INPUT VOLTAGE	MAX. LAMP OPERATING TEMPERATURE	MIN. BALLAST EFFICACY FACTOR
1	4 ft rapid start	120 or 277	less than 1000 m amp	1.805
2	4 ft rapid start	120	less than 1000 m amp	1.060
2	4 ft rapid start	277	less than 1000 m amp	1.050
2	8 ft slim-line	120-277	less than 1000 m amp	0.570

NUMBER OF LAMPS	LAMP TYPE	NOMINAL OPERATIONAL INPUT VOLTAGE	MAX. LAMP OPERATING TEMPERATURE	MIN. BALLAST EFFICACY FACTOR
2	8 ft high output, rapid start	120-277	less than 1000 m amp	0.390

*For ballasts not specifically designed for use with dimming controls

The BEF is calculated using the formula BEF = Ballast Factor, in percent/Power Input where Power Input = Total Wattage of Combined Lamps and Ballasts.

(2) Electronic Ballast. Electronic ballasts shall consist of a rectifier, high frequency converter, and power control and regulation circuitry. The ballasts shall be UL listed, Class P, with a Class A sound rating and shall contain no PCBs. Ballasts shall meet FCC Rules and Regulations, CFR 47 Part 18 for electromagnetic interference and shall not interfere with the operation of other electrical equipment. Design shall withstand line transients per IEEE C62.41, Category A. Unless otherwise indicated, the minimum number of ballasts shall be used to serve each individual fixture, using one, two, three or four lamp ballasts. A single ballast may be used to serve multiple fixtures if they are continuous mounted, factory manufactured for that installation with an integral wireway and are identically controlled.

(a) Light output regulation shall be plus or minus 10 percent.

(b) Voltage input regulation shall be plus or minus 10 percent.

(c) Lamp current crest factor shall be no more than 1.7.

(d) Ballast factor shall be not less than 85 percent nor more than 100 percent, unless otherwise indicated.

(e) A 60 Hz filter shall be provided. Flicker shall be no more than 15 percent with any lamp suitable for the ballast.

(f) Ballast case temperature shall not exceed 25 degree celsius rise above 40 degree celsius ambient, when tested in accordance with UL 935.

(g) Input current third harmonic shall not exceed 32 percent total harmonic distortion or 27.5 percent of the third triplens.

(h) Power factor shall not be less than 0.9.

(i) Ballasts shall operate at a frequency of 20 KHz or more.

(j) Operating filament voltage shall be 2.5 to 4.5 volts.

(k) Warranty. Three year full warranty including a $10 labor allowance.

(l) Ballast Efficacy Factor (BEF) shall be in accordance with the following Table. Ballasts and lamps shall be matching rapid start or instant start as indicated on the following Table. If 32W-F32-T8 lamps and ballasts are used, they must be either all rapid start or all instant start.

ELECTRONIC FLUORESCENT BALLAST EFFICACY FACTORS*

LAMP TYPE	TYPE OF STARTER & LAMP	NOMINAL OPERATIONAL INPUT VOLTAGE	NUMBER OF LAMPS	MIN. BALLAST EFFICACY FACTOR
40W F40 T12	rapid start	120 or 277 V	1	2.3
			2	1.2
			3	0.8
			4	0.6
34W F40 T12	rapid start	120 or 277 V	1	2.6
			2	1.3
			3	1.0
			4	0.7
40W F40 T10	rapid start	120 or 277 V	1	2.2
			2	1.1
			3	0.8
32W F32 T8	rapid or instant start	120 or 277 V	1	2.4
			2	1.4
			3	1.0
			4	0.8

*For ballasts not specifically designed for use with dimming controls

The BEF is calculated using the formula:

BEF = Ballast Factor (in percent) / Power Input
where Power Input = Total Wattage of Combined Lamps and Ballasts

c. Lampholders, Starters, and Starter Holders: UL 542.

2.1.4 High-Intensity-Discharge

a. Fixture: NEMA LE 4 for ceiling compatibility of recessed fixtures and UL 1572.

b. Ballasts: ANSI C82.4 for multiple supply types and UL 1029.

PART 3 EXECUTION

3.1 WIRING METHODS

Unless otherwise indicated, wiring shall consist of insulated conductors installed in rigid aluminum or rigid zinc-coated steel conduit, rigid plastic conduit, electrical metallic and/or nonmetallic tubing, or intermediate metal conduit. Nonmetallic-sheathed cables or metallic-armored cables may be installed in areas permitted by NFPA 70.

3.1.1 Sizes

Sizes shall be not less than indicated. Branch-circuit conductors shall be not smaller than No. 12 AWG. Conductors for branch circuits of 120 volts more than 100 feet long and of 277 volts more than 230 feet long, from panel to load center, shall be no smaller than No. 10 AWG.

3.2 LAMPS AND LIGHTING FIXTURES

Ballasted fixtures shall have ballasts which are compatible with the specific type and rating of lamps indicated and shall comply with the applicable provisions of the publications referenced.

3.2.1 Lamps

Lamps of the type, wattage, and voltage rating indicated shall be delivered to the project in the original cartons and installed in the fixtures just prior to the completion of the project.

3.2.1.1 Incandescent

Incandescent lamps shall be for 125-volt operation unless otherwise indicated.

3.2.1.2 Fluorescent

Fluorescent lamps shall have standard cool-white color characteristics and shall be of a type that will not require starter switches. Lamps shall be of the rapid-start type unless

otherwise shown or approved. Fluorescent lamps for electronic ballasts shall be as indicated.

3.2.1.3 High-Intensity-Discharge

High-intensity-discharge lamps shall be the high-pressure-sodium type unless otherwise indicated, shown, or approved.

3.2.2 Fixtures

Fixtures shall be as shown and shall conform to the following specifications.

3.2.2.1 Accessories

Accessories such as straps, mounting plates, nipples, or brackets shall be provided for proper installation. Open type fluorescent fixtures with exposed lamps shall have a wire-basket type guard.

3.2.2.2 Suspended Fixtures

Suspended fixtures shall be provided with swivel hangers in order to ensure a plumb installation. Pendants, rods or chains 4 feet or longer, excluding fixture, shall be braced to limit swinging. Bracing shall be 3 directional, 120 degrees apart. Single-unit suspended fluorescent fixtures shall have twin-stem hangers. Multiple-unit or continuous-row fluorescent units shall have a tubing or stem for wiring at one point, and a tubing or rod suspension provided for each length of chassis including one at each end. Maximum distance between adjacent tubing or stems shall be 10 feet. Rods shall be of not less than 3/16-inch diameter. Flexible raceway shall be installed to each fixture from an overhead junction box. Fixture to fixture wiring installation is allowed only when fixtures are installed end to end in a continuous run.

3.2.2.3 Ceiling Fixtures

Ceiling fixtures shall be coordinated with and suitable for installation in, on, or from the suspended ceiling provided under other sections of these specifications. Installation and support of fixtures shall be in accordance with the NFPA 70 and manufacturer's recommendations. Where seismic requirements are specified herein, fixtures shall be supported as shown or specified. Recessed fixtures shall have adjustable fittings to permit alignment with ceiling panels. Recessed fixtures installed in fire-resistive type of suspended ceiling construction shall have the same fire rating as the ceiling or shall be provided with fireproofing boxes having materials of the same fire rating as the ceiling panels, in conformance with UL-03. Surface-mounted fixtures shall be suitable for fastening to the structural support for ceiling panels.

3.2.2.4 Sockets

Sockets of industrial, strip, and other open type fluorescent fixtures shall be of the type requiring a forced movement along the longitudinal axis of the lamp for insertion and removal of the lamp.

3.2.3 Emergency Light Sets

Emergency light sets shall conform to UL 924 with the number of heads as indicated. Sets shall be permanently connected to the wiring system by conductors installed in short lengths of flexible conduit.

3.3 REPAIR OF EXISTING WORK

The work shall be laid out in advance, and where cutting, channeling, chasing, or drilling of floors, walls, partitions, ceiling, or other surfaces is necessary for the proper installation, support, or anchorage of the conduit, raceways, or other electrical work, damage to building, piping, or equipment shall be repaired by mechanics of the trades involved, at no additional cost to the Government.

3.4 TESTS

After the interior-wiring-system installation is completed, and at such time as the Contracting Officer may direct, the Contractor shall conduct an operating test for approval. The equipment shall be demonstrated to operate in accordance with the requirements of this specification.

END OF SECTION

SECTION 16415C

ELECTRICAL WORK, INTERIOR - WIRING

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI C37.16	(1988) Switchgear - Low-Voltage Power Circuit Breakers and AC Power Circuit Protectors - Preferred Ratings, Related Requirements, and Application Recommendations
ANSI C80.5	(1990) Rigid Aluminum Conduit

FEDERAL SPECIFICATIONS (FS)

FS L-C-530	(Rev C) Coating, Pipe, Thermoplastic Resin
FS L-P-387	(Rev A; Am 1, Int Am 2) Plastic Sheet, Laminated, Thermosetting (for Designation Plates)

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE C37.13	(1981; R 1990) Low-Voltage AC Power Circuit Breakers Used in Enclosures
IEEE C37.20.1	(1987) Metal-Enclosed Low-Voltage Power Circuit Breaker Switchgear

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA 250	(1991) Enclosures for Electrical Equipment (1000 Volts Maximum)
NEMA AB 1	(1986; Rev 1) Molded Case Circuit Breakers and Molded Case Switches
NEMA BU 1	(1988; BU 1.1-1986) Busways

NEMA FU 1	(1986) Low Voltage Cartridge Fuses
NEMA ICS 6	(1988; Rev 1) Enclosures for Industrial Control and Systems
NEMA OS 1	(1989) Sheet Steel Outlet Boxes, Device Boxes, Covers, and Box Supports
NEMA OS 2	(1986; Errata Aug 15, 1986) Nonmetallic Outlet Boxes, Device Boxes, Covers, and Box Supports
NEMA PB 1	(1990; PB 1.1) Panelboards
NEMA PB 2	(1989; PB 2.1) Deadfront Distribution Switchboards
NEMA PE 5	(1985; R 1991) Utility Type Battery Chargers
NEMA PE 7	(1985; R 1991) Communication Type Battery Chargers
NEMA RN 1	(1989) Polyvinyl-Chloride (PVC) Externally Coated Galvanized Rigid Steel Conduit and Intermediate Metal Conduit
NEMA TC 2	(1990) Electrical Polyvinyl Chloride (PVC) Tubing (EPT) and Conduit (EPC-40 and EPC-80)
NEMA TC 13	(1986) Electrical Nonmetallic Tubing (ENT)
NEMA WD 1	(1983; R 1989) General Requirements for Wiring Devices
NEMA WD 6	(1988) Wiring Devices - Dimensional Requirements

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	(1993) National Electrical Code
NFPA 101	(1991) Safety to Life from Fire in Buildings and Structures

UNDERWRITERS LABORATORIES (UL)

UL 1	(1985; Rev Jan 1992) Flexible Metal Conduit
UL 5	(1985; Rev thru Sep 1990) Surface Metal Raceways and Fittings
UL 6	(1981; Rev thru Jul 1991) Rigid Metal Conduit

UL 20	(1986; Rev thru Jul 1991) General-Use Snap Switches
UL 44	(1991; Rev Oct 1991) Rubber-Insulated Wires and Cables
UL 50	(1988; Rev thru Mar 1991) Cabinets and Boxes
UL 67	(1988; Rev thru 1991) Panelboards
UL 83	(1991; Rev Sep 1991) Thermoplastic-Insulated Wires and Cables
UL 98	(1987; Rev thru Apr 1990) Enclosed and Dead-Front Switches
UL 198B	(1988; Rev Jan 1988) Class H Fuses
UL 198C	(1986; Rev thru Jun 1990) High-Interrupting-Capacity Fuses, Current-Limiting Types
UL 198D	(1988; Rev Jul 1988) Class K Fuses
UL 198E	(1988; Rev Jul 1988) Class R Fuses
UL 198F	(1988) Plug Fuses
UL 198G	(1988; Rev May 1988) Fuses for Supplementary Overcurrent Protection
UL 198H	(1988; Rev Jun 1990) Class T Fuses
UL 198L	(1988; Rev Mar 1988) D-C Fuses for Industrial Use
UL 360	(1986; Rev thru Feb 1990) Liquid-Tight Flexible Steel Conduit
UL 486A	(1991; Rev thru Oct 1991) Wire Connectors and Soldering Lugs for Use with Copper Conductors
UL 486B	(1991; Rev Oct 1991) Wire Connectors for Use with Aluminum Conductors
UL 486C	(1991; Rev thru Jan 1992) Splicing Wire Connectors
UL 489	(1991; Rev thru May 1992) Molded-Case Circuit Breakers and Circuit-Breaker Enclosures

UL 498	(1991; Rev Jan 1992) Attachment Plugs and Receptacles
UL 510	(1986; Rev Oct 1986) Insulating Tape
UL 512	(1987) Fuseholders
UL 514A	(1991) Metallic Outlet Boxes
UL 514B	(1989; Rev thru Aug 1990) Fittings for Conduit and Outlet Boxes
UL 514C	(1988; Rev thru Jun 1989) Nonmetallic Outlet Boxes, Flush-Device Boxes, and Covers
UL 651	(1989; Rev thru Dec 1989) Schedule 40 and 80 Rigid PVC Conduit
UL 651A	(1989; Rev thru Dec 1989) Type EB and A Rigid PVC Conduit and HDPE Conduit
UL 698	(1991; Rev Nov 1991) Industrial Control Equipment for Use in Hazardous (Classified) Locations
UL 719	(1985; Rev thru Dec 1990) Nonmetallic-Sheathed Cables
UL 797	(1983; Rev thru Jul 1991) Electrical Metallic Tubing
UL 817	(1986; Rev thru May 1991) Cord Sets and Power-Supply Cords
UL 857	(1990, Errata Apr 1990) Busways and Associated Fittings
UL 869A	(1987; Rev thru Nov 1990) Reference Standard for Service Equipment
UL 891	(1984; Rev thru Jun 1991) Dead-Front Switchboards
UL 943	(1985; Rev May 1990) Ground-Fault Circuit Interrupters
UL 1236	(1986; Rev thru Apr 1990) Battery Chargers
UL 1242	(1983; Rev thru Jun 1991) Intermediate Metal Conduit

UL 1564 (1982; Rev thru Nov 1991) Industrial Battery Chargers

UL 1660 (1987) Liquid-Tight Flexible Nonmetallic Conduit

1.2 GENERAL

1.2.1 Rules

The installation shall conform to the requirements of NFPA 70 and NFPA 101, unless more stringent requirements are indicated herein or shown.

1.2.2 Coordination

The drawings indicate the extent and the general location and arrangement of equipment, conduit, and wiring. The Contractor shall become familiar with all details of the work and verify all dimensions in the field so that the outlets and equipment shall be properly located and readily accessible. Lighting fixtures, outlets, and other equipment and materials shall be located to avoid interference with mechanical or structural features; otherwise, lighting fixtures shall be symmetrically located according to the room arrangement when uniform illumination is required, or asymmetrically located to suit conditions fixed by design and shown. Raceways, junction and outlet boxes, and lighting fixtures shall not be supported from sheet metal roof decks. If any conflicts occur necessitating departures from the drawings, details of and reasons for departures shall be submitted and approved prior to implementing any change. The Electrical Contractor shall coordinate the electrical work with HVAC and electrical drawings and provide all power related wiring even if they are not shown on electrical drawings.

1.2.3 Standard Products

Material and equipment shall be a standard product of a manufacturer regularly engaged in the manufacture of the product and shall essentially duplicate items that have been in satisfactory use for at least 2 years prior to bid opening.

1.2.4 Identification Nameplates

Major items of electrical equipment and major components shall be permanently marked with an identification name to identify the equipment by type or function and specific unit number as indicated. Designation of motors shall coincide with their designation in the motor control center or panel. Unless otherwise specified, all identification nameplates shall be made of laminated plastic in accordance with FS L-P-387, with black outer layers and a white core. Edges shall be chamfered. Plates shall be fastened with black-finished round-head drive screws, except motors, or approved nonadhesive metal fasteners. When the nameplate is to be installed on an irregular-shaped object, the Contractor shall devise an approved support suitable for the application and ensure the proper installation

of the supports and nameplates. In all instances, the nameplate shall be installed in a conspicuous location. At the option of the Contractor, the equipment manufacturer's standard embossed nameplate material with black paint-filled letters may be furnished in lieu of laminated plastic. The following equipment, as a minimum, shall be provided with identification nameplates:

Minimum 1/4-Inch High Letters	Minimum 1/8-Inch High Letters
Panelboards	Control Power Transformers
Starters	Control Devices
Safety Switches	Instrument Transformers
Equipment Enclosures	
Switchgear	
Switchboards	

Each panel, section, or unit in motor control centers, switchgear or similar assemblies shall be provided with a nameplate in addition to nameplates listed above, which shall be provided for individual compartments in the respective assembly, including nameplates which identify "future," "spare," and "dedicated" or "equipped spaces."

1.2.5 As Built Drawings

Following the project completion or turnover, within 30 days the Contractor shall furnish 2 sets of as built drawings to the Contracting Officer.

1.3 SUBMITTALS

The following shall be submitted in accordance with Section 01300 SUBMITTAL DESCRIPTIONS:

1.3.1 Materials and Equipment

The label or listing of the Underwriters Laboratories, Inc., shall be accepted as evidence that the materials or equipment conform to the applicable standards of that agency. In lieu of this label or listing, a statement from a nationally recognized, adequately equipped testing agency indicating that the items have been tested in accordance with required procedures and that the materials and equipment comply with all contract requirements will be accepted. However, materials and equipment installed in hazardous locations must bear the UL label unless the data submitted from other testing agency is specifically approved in writing by the Contracting Officer. Materials and equipment shall be approved based on the manufacturer's published data.

For other than equipment and materials specified to conform to UL publications, a manufacturer's statement indicating complete compliance with the applicable Federal Specification, or standard of the American Society for Testing and Materials, National Electrical Manufacturers Association, or other commercial standard, is acceptable.

1.4 WORKMANSHIP

Materials and equipment shall be installed in accordance with recommendations of the manufacturer and as shown.

PART 2 PRODUCTS

2.1 MATERIALS AND EQUIPMENT

Materials and equipment shall conform to the respective publications and other requirements specified below. Materials and equipment not listed below shall be as specified elsewhere in this section.

2.1.1 Busways

UL 857. Busses shall be copper. Enclosures shall be steel. Short-circuit ratings, except as indicated, shall be in accordance with NEMA BU 1.

2.1.1.1 Feeder Busways

Feeder busways shall be ventilated, except that vertical busways within 6 feet 0 inch of floors shall be unventilated low-impedance busway.

2.1.2 Cables and Wires

Conductors in cables shall be annealed copper, except that AA-8000 series aluminum conductors may be used as an equivalent for copper conductors of No. 6 AWG or larger. Intermixing of copper and aluminum conductors in these sizes is not permitted. Design is based on copper conductors and aluminum conductors shall have an ampacity not less than that of the indicated copper conductors. Cables shall be single-conductor type, unless otherwise indicated. Cables and wires shall conform to UL 44 for rubber-insulated type; UL 83 for the thermoplastic-insulated type; and UL 719 for the nonmetallic-sheathed cables. The following types shall be provided.

2.1.2.1 Metallic Armored Cable

Type ACHH or ACT.

2.1.2.2 Nonmetallic Sheathed Cables

Type NM or NMC, with ground conductor.

2.1.2.3 Service Entrance Cable

Type SE.

2.1.2.4 Grounding Cables

Grounding cables shall be bare or shall have green low-voltage insulation.

2.1.2.5 Cord Sets and Power-Supply Cords

UL 817.

2.1.3 Circuit Breakers

Circuit breakers shall have voltage, current and interrupting ratings as indicated. Fully rated circuit breakers or series rated circuit breakers in combinations approved for series applications by UL shall be provided as indicated, for specific pieces of distribution equipment, to obtain the specified interrupting rating. The fully rated circuit breakers will be acceptable where the series rated is specified. Panelboards or individual enclosures containing series rated circuit breakers shall be appropriately marked for use with the specified breakers at the designated short circuit level.

2.1.3.1 Molded-Case Circuit Breakers

NEMA AB 1 and UL 489 for circuit breakers.

a. Molded-Case Circuit Breakers: Single-pole breakers shall be full module size; two poles shall not be installed in a single module. Multipole breakers shall be of the common-trip type having a single operating handle, but for sizes of 100 amperes or less may consist of single-pole breakers permanently factory assembled into a multipole unit having an internal, mechanical, nontamperable common-trip mechanism and external handle ties. Breakers shall have interchangeable, adjustable magnetic, trips in 225 amperes frame and larger. Breakers coordinated with current-limiting fuses shall have a combined interrupting capacity of 100,000 symmetrical amperes. All poles of associated breakers shall open if any fuse blows.

2.1.3.2 Ground Fault Circuit Interrupters

UL 943. Breakers equipped with ground fault interrupters shall have ground fault class, interrupting capacity, and voltage and current ratings as indicated.

2.1.4 Conduit and Tubing

2.1.4.1 Electrical, Zinc-Coated Steel Metallic Tubing (EMT)

UL 797.

2.1.4.2 Electrical Nonmetallic Tubing (ENT)

NEMA TC 13.

2.1.4.3 Electrical Plastic Tubing and Conduit

NEMA TC 2.

2.1.4.4 Flexible Conduit, Steel and Plastic

General-purpose type, UL 1; liquid tight, UL 360, and UL 1660

2.1.4.5 Intermediate Metal Conduit

UL 1242.

2.1.4.6 PVC Coated Rigid Steel Conduit

NEMA RN 1.

2.1.4.7 Rigid Aluminum Conduit

ANSI C80.5 and UL 6.

2.1.4.8 Rigid Metal Conduit

UL 6.

2.1.4.9 Rigid Plastic

NEMA TC 2, UL 651 and UL 651A.

2.1.5 Conduit and Device Boxes and Fittings

2.1.5.1 Boxes, Metallic Outlet

NEMA OS 1 and UL 514A.

2.1.5.2 Boxes, Nonmetallic, Outlet and Flush-Device Boxes and Covers

NEMA OS 2 and UL 514C.

2.1.5.3 Boxes, Switch (Enclosed), Surface-Mounted

UL 98.

2.1.5.4 Fittings for Conduit and Outlet Boxes

UL 514B.

2.1.5.5 Fittings, PVC, for Use with Rigid PVC Conduit and Tubing UL

514B.

2.1.6 Conduit Coatings Plastic Resin System

FS L-C-530 or NEMA RN 1, Type A-40.

2.1.7 Connectors, Wire Pressure

2.1.7.1 Copper Conductors

UL 486A.

2.1.7.2 Aluminum Conductors

UL 486B.

2.1.8 Enclosures

NEMA ICS 6 or NEMA 250 unless otherwise specified.

2.1.8.1 Cabinets and Boxes

UL 50.

2.1.8.2 Circuit Breaker

UL 489.

2.1.9 Fuses and Fuseholders

2.1.9.1 Fuses, Low Voltage Cartridge Type

NEMA FU1.

2.1.9.2 Fuses, High-Interrupting-Capacity, Current-Limiting Type

UL 198C.

2.1.9.3 Fuses, Class K, High-Interrupting-Capacity Type

UL 198D.

2.1.9.4 Fuses, Class H

UL 198B.

2.1.9.5 Fuses, Class R

UL 198E.

2.1.9.6 Fuses, Class T

UL 198H.

2.1.9.7 Fuses, Plug Type

UL 198F.

2.1.9.8 Fuses for Supplementary Overcurrent Protection

UL 198G.

2.1.9.9 Fuses, D-C for Industrial Use

UL 198L.

2.1.9.10 Fuseholders

UL512.

2.1.10 Panelboards

Dead-front construction, NEMA PB 1 and UL 67.

2.1.11 Receptacles

2.1.11.1 Hospital Grade

UL498.

2.1.11.2 General Grade

NEMA WD1.

2.1.11.3 Standard Grade

UL498.

2.1.11.4 Ground Fault Interrupters

UL 943, Class A or B.

2.1.12 Service Equipment

UL 869A.

2.1.13 Splice, Conductor

UL 486C.

2.1.14 Switchboard, Dead Front Distribution

NEMA PB 2 and UL 891.

2.1.15 Switchgear Assemblies, Power

IEEE C37.20.1.

2.1.16 Snap Switches

UL 20.

2.1.17 Tapes

2.1.17.1 Plastic Tape

UL510.

2.1.17.2 Rubber Tape

UL510.

2.1.18 Wiring Devices

NEMA WD 1 for general-purpose wiring devices, and NEMA WD 6 for dimensional requirements of wiring devices.

PART 3 EXECUTION

3.1 WIRING METHODS

Unless otherwise indicated, wiring shall consist of insulated conductors installed in rigid aluminum or rigid zinc-coated steel conduit, rigid plastic conduit, electrical metallic and/or nonmetallic tubing, or intermediate metal conduit. Nonmetallic-sheathed cables or metallic-armored cables may be installed in areas permitted by NFPA 70.

3.1.1 Conduit and Tubing Systems

Conduit and tubing systems shall be installed as indicated. Conduit sizes shown are based on use of copper conductors with insulation types as described in paragraph WIRING METHODS. Minimum size of raceways shall be 1/2 inch. Only metal conduits will be permitted when conduits are required for shielding or other special purposes indicated, or when required by conformance to NFPA 70. Nonmetallic conduit and tubing may be used in damp, wet or corrosive locations when permitted by NFPA 70 and the conduit or tubing system is provided with appropriate boxes, covers, clamps, screws or other appropriate type of fittings. Electrical metallic tubing may be installed only within buildings. Electrical metallic tubing may be installed in concrete and grout in dry locations. Electrical metallic tubing installed in concrete or grout shall be provided with concrete tight fittings. EMT will not be installed in damp or wet locations. Bushings, manufactured fittings or boxes providing equivalent means of protection shall be installed on the ends of all conduits and shall be of the insulating type, where required by NFPA 70. Only UL listed adapters shall be used to connect EMT to rigid metal conduit, cast boxes, and conduit bodies. Aluminum conduit may be used only where installed exposed in dry locations. Nonaluminum sleeves shall be used where aluminum conduit passes through concrete floors and firewalls. Except as otherwise specified, IMC may be used as an option for rigid steel conduit in areas as permitted by NFPA 70. Raceways shall not

be installed under the firepits of boilers and furnaces and shall be kept 6 inches away from parallel runs of flues, steam pipes and hot-water pipes. Raceways shall be concealed within finished walls, ceilings, and floors unless otherwise shown. Raceways crossing structural expansion joints shall be provided with suitable expansion fittings or other suitable means to compensate for the building expansion and contraction and to provide for continuity of grounding. Wiring installed in underfloor duct system shall be suitable for installation in wet locations.

3.1.1.1 Below Slab-on-Grade or in the Ground

All electrical wiring below slab-on-grade shall be protected by a conduit system. Conduit passing vertically through slabs-on-grade shall be rigid steel or IMC. Rigid steel or IMC conduits installed below slab-on-grade or in the earth shall be field-wrapped with 0.010-inch thick pipe-wrapping plastic tape applied with a 50-percent overlay, or shall have a factory-applied polyvinyl chloride, plastic resin, or epoxy coating system.

3.1.1.2 Installing in Slabs Including Slabs on Grade

Conduits shall be installed as close to the middle of concrete slabs as practicable without disturbing the reinforcement. Outside diameter shall not exceed 1/3 of the slab thickness and conduits shall be spaced not closer than 3 diameters on centers except at cabinet locations where the slab thickness shall be increased as approved by the Contracting Officer.

3.1.1.3 Changes in Direction of Runs

Changes in direction of runs shall be made with symmetrical bends or cast-metal fittings. Field-made bends and offsets shall be made with an approved hickey or conduit-bending machine. Crushed or deformed raceways shall not be installed. Trapped raceways in damp and wet locations shall be avoided where possible. Care shall be taken to prevent the lodgment of plaster, dirt, or trash in raceways, boxes, fittings and equipment during the course of construction. Clogged raceways shall be entirely freed of obstructions or shall be replaced.

3.1.1.4 Supports

Metallic conduits and tubing shall be securely and rigidly fastened in place at intervals of not more than 10 feet and within 3 feet of boxes, cabinets, and fittings, with approved pipe straps, wall brackets, conduit clamps, conduit hangers, threaded C-clamps, or ceiling trapeze. C-clamps or beam clamps shall have strap or rod-type retainers. Rigid plastic conduits (if permitted as a wiring method) shall be supported as indicated above, except that they will be supported at intervals as indicated in NFPA 70. Loads and supports shall be coordinated with supporting structure to prevent damage or deformation to the structures, but no load shall be applied to joist bridging. Fastenings shall be by wood

screws or screw-type nails to wood; by toggle bolts on hollow masonry units; by expansion bolts on concrete or brick; by machine screws, welded threaded studs, heat-treated or spring-steel-tension clamps on steel work. Nail-type nylon anchors or threaded studs driven in by a powder charge and provided with lock washers and nuts may be used in lieu of expansion bolts or machine screws. Raceways or pipe straps shall not be welded to steel structures. Holes cut to a depth of more than 1-1/2 inches in reinforced concrete beams or to a depth of more than 3/4-inch in concrete joists shall avoid cutting the main reinforcing bars. Holes not used shall be filled. In partitions of light steel construction, sheet-metal screws may be used. Conduit shall not be supported using wire or nylon ties. Raceways shall be installed as a complete system and be independently supported from the structure. Upper raceways shall not be the support of lower raceways. Supporting means will not be shared between electrical raceways and mechanical piping or ducts and shall not be fastened to hung ceiling supports. Conduits shall be fastened to all sheet-metal boxes and cabinets with two locknuts where required by the NFPA 70, where insulating bushings are used, and where bushings cannot be brought into firm contact with the box; otherwise, a single locknut and bushing may be used. Threadless fittings for electrical metallic tubing shall be of a type approved for the conditions encountered. A pull wire shall be inserted in each empty raceway in which wiring is to be installed by others if the raceway is more than 50 feet in length and contains more than the equivalent of two 90-degree bends, or where the raceway is more than 150 feet in length. The pull wire shall be of No. 14 AWG zinc-coated steel, or of plastic having not less than 200-pound tensile strength. Not less than 10 inches of slack shall be left at each end of the pull wire. Additional support for horizontal runs is not required when EMT rests on steel stud cutouts.

3.1.2 Cable Systems

Cables shall be installed concealed behind ceiling or wall finish where practicable. Cables shall be threaded through holes bored on the approximate centerline of wood members; notching of surfaces will not be permitted. Sleeves shall be provided through bond beams of masonry-block walls for threading cables through hollow spaces. Exposed cables shall be installed parallel or at right angles to walls or structural members. In rooms or areas not provided with ceiling or wall finish, cables and outlets shall be installed so that a room finish may be applied in the future without disturbing the cables or resetting the boxes. Exposed nonmetallic-sheathed cables less than 4 feet above floors shall be protected from mechanical injury by installation in conduit or tubing.

3.1.3 Cables and Conductors

Aluminum conductors shall have ampacity of not less than the copper conductors. Wire connectors of insulating material or solderless pressure connectors properly taped shall be utilized for all splices. Pressure connectors for aluminum conductors shall have tinned aluminum bodies. Aluminum contact surfaces of conductors and connectors shall be cleaned and covered with antioxidant compound prior to making of connections.

3.1.3.1 Sizes

All sizes are based on copper conductors, unless otherwise indicated. Sizes shall be not less than indicated. Branch-circuit conductors shall be not smaller than No. 12 AWG. Conductors for branch circuits of 120 volts more than 100 feet long and of 277 volts more than 230 feet long, from panel to load center, shall be no smaller than No. 10 AWG. Class 1 remote control and signal circuit conductors shall be not less than No. 14 AWG. Class 2 remote control and signal circuit conductors shall be not less than No. 16 AWG.

The conductor sizes are based on the use of TW insulation for conductors smaller than No. 1/0 AWG and THW insulation for conductors No. 1/0 and larger, except where otherwise indicated.

Higher temperature rated conductors will be permitted, if the UL tested temperature ratings for which the equipment in the circuit is marked are not exceeded.

Conductor sizes for nonlinear loads shall be based on the use of minimum 75 degrees C insulated conductors for branch circuits and feeders.

3.1.3.2 Power Conductor Identification

All phase conductors shall be identified by color-coding. The color of the insulation on the phase conductors of different voltage systems shall be as follows:

120/208 volt, 3-phase: black, red, and blue.

277/480 volt, 3-phase: Brown, orange, and yellow.

120/240 volt, single/phase: Black and red.

Conductor phase and voltage identification shall be made by color-coded insulation for all conductors smaller than No. 6 AWG. For conductors No. 6 AWG and larger, identification shall be made by color-coded insulation, or conductors with black insulation may be furnished and identified by the use of half-lapped bands of colored electrical tape wrapped around the insulation for a minimum of 3 inches of length near the end, or other method as submitted by the Contractor and approved by the Contracting Officer. Conductor identification shall be provided within each enclosure where a tap, splice, or termination is made. Phase identification by a particular color shall be maintained continuously for the length of a circuit, including junctions.

3.1.3.3 Control Conductor Identification

Control circuit conductor identification shall be made by color-coded insulated conductors, plastic-coated self-sticking printed markers, permanently attached stamped

metal foil markers, or equivalent means as approved. Control circuit terminals of equipment shall be properly identified. Terminal and conductor identification shall match that shown on approved detail drawings. Hand lettering or marking is not acceptable.

3.2 RECEPTACLES

3.2.1 Single and Duplex

Single and duplex receptacles shall be rated 15 amperes, 125 volts, two-pole, three-wire, grounding type with polarized parallel slots. Bodies shall be of brown or ivory to match color of switch handles in the same room or to harmonize with the color of the respective wall, and supported by mounting strap having plaster ears. Contact arrangement shall be such that contact is made on two sides of an inserted blade. Receptacle shall be side- or back-wired with two screws per terminal. The third grounding pole shall be connected to the metal mounting yoke. Switched receptacles shall be the same as other receptacles specified except that the ungrounded pole of each suitable receptacle shall be provided with a separate terminal. Only the top receptacle of a duplex receptacle shall be wired for switching application. Receptacles with ground fault circuit interrupters shall have the current rating as indicated, and shall be UL Class A type unless otherwise shown. Ground fault circuit protection shall be provided as required by the NFPA 70 and in the following receptacle locations: exterior including those on roofs, bathrooms with showers, shops, hangars, and garages.

3.2.2 Weatherproof

Weatherproof receptacles shown shall be mounted in a box with a gasketed, weatherproof, cast-metal cover plate and gasketed cap over each receptacle opening. The cap shall be provided with a spring-hinged flap.

3.2.3 Receptacles, 15-Ampere, 250-Volt

Receptacles, 15-ampere, 250-volt, shall be duplex two-pole, three-wire, grounding type with bodies of ivory phenolic compound supported by mounting yoke having plaster ears. The third grounding pole shall be connected to the metal yoke. Each receptacle shall be provided with a mating cord-grip cap.

3.3 WALL SWITCHES

Wall switches shall be of the totally enclosed tumbler type. The wall switch handle and switch plate color shall harmonize with the color of the respective wall. Wiring terminals shall be of the screw type or of the solderless pressure type having suitable conductor-release arrangement. Not more than two switches shall be installed in a single-gang position. Switches shall be rated 15-ampere 120-volt for use on alternating current only. Pilot lights indicated shall consist of yoke-mounted candelabra- base

sockets rated at 75 watts, 125 volts, and fitted with glass or plastic jewels. A clear 6-watt lamp shall be furnished and installed in each pilot switch. Jewels for use with switches controlling motors shall be green, and jewels for other purposes shall be red. Dimming switches shall be solid-state flush mounted, sized for the loads.

3.4 FUSES

Equipment provided under this contract shall be provided with a complete set of properly rated fuses when the equipment manufacturer utilize fuses in the manufacture of the equipment, or if current-limiting fuses are required to be installed to limit the ampere-interrupting-capacity of circuit breakers or equipment to less than the maximum available fault current at the location of the equipment to be installed. Fuses shall have a voltage rating of not less than the phase-to-phase circuit voltage, and shall have the time-current characteristics required for effective power system coordination.

3.4.1 Plug Fuses

Plug fuses shall be of the nonrenewable time-delay type and shall be used for circuits rated 125 volts or less and 30 amperes or less.

3.5 AERIAL SERVICE

Aerial power-service entrance conductors which originate at a power-supply transformer shall be rigidly supported from an approved type of malleable-iron structural support specifically designed and manufactured for the application, and for mounting to an exterior wall. The service-entrance conductors shall be continuous between the power-supply transformer and the service-entrance meter enclosure and shall be routed from the structural support to a weatherhead, or weatherproof conduit fitting, before entry into an enclosing conduit. At least 4 feet of slack shall be provided in the service-entrance conductors, which shall be formed to provide a drip-loop, between the structural support and the weatherproof conduit fitting. The weatherproof service-entrance fitting shall be securely fastened to a rigid-galvanized steel (RGS) conduit that shall be terminated in the meter enclosure which penetrates the exterior wall. Penetration of the conduit through an exterior wall shall be sealed in an approved manner to prevent the entrance of moisture, and the escape of conditioned air. Service-entrance conductors shall be routed in intermediate metal conduit (IMC) in the exterior wall, or in the interior of the building or facility that contains the meter enclosure.

3.6 REPAIR OF EXISTING WORK

The work shall be laid out in advance, and where cutting, channeling, chasing, or drilling of floors, walls, partitions, ceiling, or other surfaces is necessary for the proper installation, support, or anchorage of the conduit, raceways, or other electrical work. Damage to

building, piping, or equipment shall be repaired by skilled mechanics of the trades involved, at no additional cost to the Government.

3.7 TESTS

After the interior-wiring-system installation is completed, and at such time as the Contracting Officer may direct, the Contractor shall conduct an operating test for approval. The equipment shall be demonstrated to operate in accordance with the requirements of this specification. Continuity test shall be conducted on the telephone wiring system. The test shall be performed in the presence of the Contracting Officer. The Contractor shall furnish all instruments and personnel required for the tests, and the Government will furnish the necessary electric power. No part of the electrical distribution system shall be energized prior to the resistance testing of that systems ground rods and submission of test results to the Contracting Officer. Test reports shall indicate the location of the rod and the resistance and the soil conditions at the time the test was performed.

END OF SECTION

SECTION 16415D

ELECTRICAL WORK, INTERIOR - GROUNDING

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI C135.30	(1988) Zinc-Coated Ferrous Ground Rods for Overhead or Underground Line Construction

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE Std 81	(1983) Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Ground System

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	(1993) National Electrical Code
NFPA 101	(1991) Safety to Life from Fire in Buildings and Structures

UNDERWRITERS LABORATORIES (UL)

UL 467	(1984; Rev thru Nov 1986) Grounding and Bonding Equipment

1.2 GENERAL

1.2.1 Rules

The installation shall conform to the requirements of NFPA 70 and NFPA 101, unless more stringent requirements are indicated herein or shown.

1.2.2 Coordination

The drawings indicate the extent and the general location and arrangement of equipment, conduit, and wiring. The Contractor shall become familiar with all details of the work and

verify all dimensions in the field so that the outlets and equipment shall be properly located and readily accessible. If any conflicts occur necessitating departures from the drawings, details of and reasons for departures shall be submitted and approved prior to implementing any change.

1.2.3 Standard Products

Material and equipment shall be a standard product of a manufacturer regularly engaged in the manufacture of the product and shall essentially duplicate items that have been in satisfactory use for at least 2 years prior to bid opening.

1.2.4 As Built Drawings

Following the project completion or turnover, within 30 days the Contractor shall furnish 2 sets of as built drawings to the Contracting Officer.

1.3 SUBMITTALS

The following shall be submitted in accordance with Section 01300 SUBMITTAL DESCRIPTIONS:

1.3.1 Materials and Equipment

The label or listing of the Underwriters Laboratories, Inc., shall be accepted as evidence that the materials or equipment conform to the applicable standards of that agency. In lieu of this label or listing, a statement from a nationally recognized, adequately equipped testing agency indicating that the items have been tested in accordance with required procedures and that the materials and equipment comply with all contract requirements will be accepted. However, materials and equipment installed in hazardous locations must bear the UL label unless the data submitted from other testing agency is specifically approved in writing by the Contracting Officer.

1.4 WORKMANSHIP

Materials and equipment shall be installed in accordance with recommendations of the manufacturer and as shown.

PART 2 PRODUCTS

2.1 GROUND RODS

Ground rods shall be of copper-clad steel conforming to UL 467 not less than 3/4 inch in diameter by 10 feet in length of the sectional type driven full length into the earth.

2.2 GROUND BUS

The ground bus shall be bare conductor or flat copper in one piece, if practicable.

PART 3 EXECUTION

3.1 GROUNDING

Grounding shall be in conformance with NFPA 70, the contract drawings, and the following specifications.

3.1.1 Ground Rods

The resistance to ground shall be measured using the fall-of-potential method described in IEEE Std 81. The maximum resistance of a driven ground shall not exceed 25 ohms under normally dry conditions. If this resistance cannot be obtained with a single rod, additional rods not less than 6 feet on centers, or if sectional type rods are used, additional sections may be coupled and driven with the first rod. In high-ground-resistance, UL listed chemically charged ground rods may be used. If the resultant resistance exceeds 25 ohms measured not less than 48 hours after rainfall, the Contracting Officer shall be notified immediately. Connections below grade shall be fusion welded. Connections above grade shall be fusion welded or shall use UL 467 approved connectors.

3.1.2 Grounding Conductors

A green ground wire shall be furnished regardless of the type of conduit. All equipment grounding conductors, including metallic raceway systems used as such, shall be bonded or joined together in each wiring box or equipment enclosure. Metallic raceways and grounding conductors shall be checked to assure that they are wired or bonded into a common junction. Metallic boxes and enclosures, if used, shall also be bonded to these grounding conductors by an approved means per NFPA 70. When boxes for receptacles, switches, or other utilization devices are installed, any designated grounding terminal on these devices shall also be bonded to the equipment grounding conductor junction with a short jumper.

3.2 TESTS

No part of the electrical distribution system shall be energized prior to the resistance testing of that system's ground rods. Test reports shall indicate the location of the rod and the resistance and the soil conditions at the time the test was performed.

END OF SECTION